Regional Economic Implications of the Mountain Pine Beetle Infestation in the Northern Interior Forest Region of British Columbia

Mike Patriquin, Scott Heckbert, Christy Nickerson, Michelle Spence, Bill White

Mountain Pine Beetle Initiative
Working Paper 2005–3

Natural Resources Canada | Ressources naturelles Canada

Canada

This publication is funded by the Government of Canada through the Mountain Pine Beetle Initiative, a program administered by Natural Resources Canada, Canadian Forest Service.

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2005

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Printed in Canada

Abstract

Economic impact analysis provides assistance to policy makers with respect to implications of policy options or external influences on the economic system. This report investigates the regional economic impacts resulting from the current mountain pine beetle infestation in the Northern Interior Forest Region of British Columbia, Canada. Two study areas within the Northern Interior are investigated: the Nadina Forest District (comprised of the Morice Timber Supply Area and the Lakes Timber Supply Area) and the Prince George Timber Supply Area (also known as the McGregor Model Forest). Baseline general equilibrium economic databases are constructed for each region using primary and secondary sources. The databases are then used in the construction of a computable general equilibrium model for each region, which are used to simulate future economic indicator levels under different scenarios related to the impact of the mountain pine beetle on timber supply. The potential offsetting impacts of increased agricultural activity and tourism activity are also examined. The scenario analysis provides similar results for both regions. On average, reductions in timber supply resulting from the mountain pine beetle infestation will have serious negative consequences for all sectors of each economy. In both cases, increased tourism activity could partially or fully offset the impact on employment; it will offset the negative impact on monetary indicators to lesser extents. Increased traditional agricultural activity has minimal offsetting impact in terms of employment and monetary indicators. The computable general equilibrium models constructed for each region provide a decision support tool that can assist decision-makers with mitigation planning for the anticipated reductions in timber supply.

Résumé

Une analyse d'impact économique aide les responsables des politiques à évaluer les répercussions des diverses options stratégiques ou des facteurs externes sur le système économique. Le présent rapport évalue l'impact économique régional de l'infestation de dendroctones du pin ponderosa qui sévit à l'heure actuelle dans la région forestière de l'Intérieur nord de la Colombie-Britannique, au Canada. Deux secteurs sont à l'étude : le district forestier de Nadina (qui comprend la zone d'approvisionnement forestier de Morice et la zone d'approvisionnement forestier de Lakes) ainsi que la zone d'approvisionnement forestier de Prince George (aussi connue sous le nom de Forêt modèle McGregor). Des bases de données économiques de référence sur l'équilibre général sont mises sur pied pour chacune des régions au moyen de sources primaires et secondaires. Ces bases de données permettront de bâtir des modèles informatiques d'équilibre général pour chacune des régions; ces modèles serviront à simuler les niveaux futurs des indicateurs économiques dans diverses situations liées à l'impact du dendroctone du pin ponderosa sur l'approvisionnement en bois. On y étudie également les effets compensateurs possibles de l'accroissement de l'activité agricole et touristique. L'analyse des diverses situations a donné des résultats semblables dans les deux régions. On a constaté que, en moyenne, la réduction des stocks d'arbres attribuable à l'infestation de dendroctones du pin ponderosa aura de lourdes conséquences pour tous les secteurs des deux régions. Dans les deux cas, l'accroissement de l'activité touristique pourrait compenser en partie ou entièrement les pertes d'emploi, mais cela aura une moins grande incidence sur les répercussions négatives affectant les indicateurs monétaires. L'intensification de l'activité agricole traditionnelle n'influe que très peu sur l'emploi et les indicateurs monétaires. Les modèles informatiques d'équilibre général mis au point pour chacune des régions offrent un outil d'aide à la décision qui peut être utile aux décideurs pour planifier des mesures d'atténuation relativement à la réduction prévue des stocks d'arbres.

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Introduction

Natural disturbances, global market influences, and policy changes are factors that drive change in small regional economies in western Canada. Overall, these forces influence regional sustainability, thereby producing the need to examine increasingly complex tradeoffs on limited landscapes. At larger scales (provincial and national), statistical agencies collect and track information with respect to the state of the economy. This information can also be used to construct general equilibrium models that are capable of simulating alternative future indicator levels under various scenarios to investigate how policy changes or external influences may affect domestic economies. Although these studies are common at the larger scale, they are uncommon on a regional basis—but no less important.

The mountain pine beetle (*Dendroctonus ponderosae)* is an endemic forest insect that is part of the natural disturbance regime in western Canadian pine forests. This particular form of natural disturbance has drastically influenced the forest landscape and, as a result, the available timber supply that supports many communities in British Columbia. The current beetle infestation in British Columbia is the largest outbreak in recorded history and, although the overall provincial economy may be able to absorb the future loss of timber supply, the impact on regional economies within the Northern Interior Forest Region may be acute. Quantifying potential adverse impacts and designing policies to reduce user conflicts and promote sustainable development require a detailed description of the current level of economic activity on the land base within each region of investigation. This task is often complicated by lack of access to regional socio-economic data.

In order to assess the strengths and weaknesses of an area's economy, an economic overview of the area is required to determine the relative size of each sector of an economy. An economic overview provides a snapshot of the state of the economy by reporting on a suite of traditional economic indicators, including revenue, net regional product, royalties and indirect taxes, income, and employment. This baseline economic data can be used to quantitatively support intuitive knowledge of the economy and to construct economic impact models that allow for simulation of future economic conditions under a range of potential scenarios.

On a regional scale, data are readily available on indicators such as employment, educational attainment, household income levels and distribution, population levels, and real estate values in the form of Statistics Canada census reports. Alternatively, the input–output (I–O) tables that contain the detailed transactions and levels of activity within an economy exist only at the national and provincial level. Survey data collection techniques can provide the most reliable, up-to-date information available when there are gaps in secondary data. However, surveys are expensive in terms of money and time. A hybrid approach to data collection using both targeted primary surveys and secondary data sources balances accuracy and expense, and is adopted in this study.

This report has three objectives:

1) To provide a baseline snapshot of the economies of two study areas within the Northern Interior Forest Region of British Columbia that are experiencing a heavy level of mountain pine beetle infestation: the Nadina Forest District (also known as the Morice Lakes Innovative Forest Practices Agreement Area) and the Prince George Timber Supply Area (Prince GeorgeTSA); also known as the McGregor Model Forest).
2) To report on the results of a preliminary scenario analysis performed using a computable general equilibrium model for each study region. The scenario analysis is used to simulate future economic indicator levels given the potential for reductions in timber supply.
3) To examine the potential impacts of increased traditional agricultural activity and tourism activity.

Environmental Setting of the Study Areas

Figure 1 displays the Nadina Forest District—comprised of the Morice Timber Supply Area (TSA) and the Lakes TSA—and the Prince George TSA in the context of British Columbia (BCMoF 2003).

Figure 1. Northern Interior Forest Region.

The Nadina Forest District

The Morice and Lakes TSAs are two of 13 TSAs comprising the Northern Interior Forest Region[*] which in turn is one of three designated forest regions in British Columbia (Figure 1). Lying along the western edge of British Columbia's Interior Plateau, the 1.12-million-hectare Lakes TSA includes the communities of Burns Lake and Grassy Plains. The slightly larger Morice TSA covers 1.5 million hectares, immediately northwest of the Lakes TSA. Its major communities include Houston, Granisle, and Topley.

The topography of the area is rolling and gentle to the north and east, and more mountainous in the southwest. Both timber supply areas are bordered by Tweedsmuir Provincial Park to the south, and are covered by a number of water bodies: three major rivers—Bulkley, Morice, and Nadina—and three major lakes: Babine, in the north (the longest and largest freshwater lake in British Columbia), and Francois and Ootsa lakes (part of the Nechako Reservoir) in the south. Other lakes comprising the Nechako Reservoir are Cheslatta, Whitesail, Tahtsa, Eutsuk, Tetachuck, Natalkuz, and Knewstubb lakes.

This report gathers information from a number of secondary sources, some of which investigate forest districts rather than timber supply areas. In addition to the partitioning of the Northern Interior Forest Region into 13 TSAs, it has also been categorized into nine forest districts. For the purposes of this report, information from secondary sources related to the Morice or Lakes forest districts, recently consolidated to form the Nadina Forest District, have been directly applied to the Morice and Lakes TSAs, as the borders of the Morice TSA and district roughly correspond, and those of the Lakes TSA and district

[*] Prior to April 1, 2003, the province's organizational structure consisted of three regions instead of six, and of 29 districts instead of 40. The Prince Rupert Forest Region and the Prince George Forest Region were combined to create the Northern Interior Forest Region, and the Morice and Lakes TSAs within the Prince Rupert Forest Region were combined to form the Nadina Forest District.

differ only in that the district includes the northern portion of Tweedsmuir Provincial Park and Tweedsmuir Recreation Area (approximately 456,600 ha). Although this area accounts for 17% of the 2.6-million-hectare study area, it is unpopulated, and its inclusion or exclusion has little effect on economic-activity estimates.

Morice and Lakes Innovative Forest Practices Agreement

In 1999, six forest licensees operating in the Morice and Lakes TSAs and the British Columbia (B.C.) Ministry of Forests' small business programs[*] in both districts joined to form the Morice and Lakes Innovative Forest Practices Agreement. Initially established under the Jobs and Timber Accord, and now mandated under the *Forest Practices Code of British Columbia Act* through the Innovative Forest Practices Regulation, provincial pilot programs or innovative forest practices agreements (IFPAs) are intended to encourage new approaches to forest management. The pilots are voluntary agreements between major local forest companies and the B.C. Ministry of Forests; each is tailored to address local concerns and issues. At present there are seven IFPA pilots in B.C. that involve 20 forest companies. One requirement of an IFPA is the preparation of a forestry plan that describes the agreement's intent and the activities it will implement (M-L IFPA 2003).

To satisfy this requirement, the Morice and Lakes IFPA has made as its primary objective the development and implementation of a sustainable forest management plan for the Morice and Lakes TSAs. The plan will detail management objectives, innovative management practices, and key performance indicators for resource management in each TSA. It will be based on three key elements of sustainability: social acceptability, environmental soundness, and economic viability. It is this last element—economic viability—that prompts completion of an economic overview of the overall regional economy of the Morice and Lakes TSAs.

The organizations and companies noted below provide guidance and support to the Morice and Lakes IFPA (Petterson 2002):

- Babine Forest Products Company
- B.C. Ministry of Forests
- B.C. Ministry of Sustainable Resource Management
- B.C. Ministry of Water, Land and Air Protection
- Canadian Forest Products Ltd.
- Decker Lake Forest Products Ltd.
- District of Houston
- Houston Forest Products Company
- L & M Lumber Ltd.
- McGregor Model Forest Association
- Natural Resources Canada
- Fraser Lake Sawmills
- Village of Burns Lake
- Village of Granisle

Economic History

Until the late 1800s, the area was primarily used by the Carrier aboriginal peoples to sustain a traditional lifestyle based on fishing, hunting, trapping, and gathering (Ministry of Sustainable Resource Management 2000). The construction of the Collins Overland Telegraph Line in the 1860s initiated non-aboriginal settlement in the area, and in the late 1800s more settlers were lured into the area by inexpensive homesteads. Eventually, with the introduction of rail service, agriculture became an important means of livelihood, with commercial seed (forage seed) production being the main activity. Today, the major agricultural export product is beef cattle, destined primarily for Alberta feed lots (MSRM 2000).

The construction of the Grand Trunk Pacific Railway in the early 1900s gave rise to the regional forest industry, which further stimulated settlement. In 1914, the railway was completed and the main forest industry, the handcutting of ties and bridge timbers, was replaced by a demand for wood used in housing

[*] On April 1, 2003, B.C. Timber Sales replaced the Small Business Forest Enterprise Program (SBFEP).

construction. The demand for wood increased with the post-World War II boom, and small sawmills became common in the area: by 1958, there were 84 small sawmills operating in the Morice TSA (MSRM 2004). As forest management became more complex and the industry more highly integrated, these smaller firms were bought out by larger, more efficient sawmills (MSRM 2000).

The area also experienced a high level of mining activity following the construction of the railway, as several mining operations thrived in the area during the 1900s. In the Lakes TSA, this included the Silver Fox mine on Taltapin Lake, several small operations on Chikamin Mountain, and one operation on the south shore of Francois Lake (Government of British Columbia 2001). In the Morice TSA, the Bell Copper mine, the Granisle mine, the Equity Silver mine, Dome Mountain, and Nadina Silver all operated during the last 20 years (Horn and Tamblyn 2000). Today, there is only one active mining operation in the study area: the Huckleberry Copper mine located in the Morice TSA.

The study area includes numerous parks and recreation sites. Summer activities include fishing, camping, hiking, hunting, boating, climbing, canoeing, wildlife viewing, and all-terrain vehicle use. Recreational use is high in winter, with snowmobiling, ice fishing, and cross-country and backcountry skiing being the most popular activities. Tourism and recreation may offer significant development potential for the region.

Major Communities

According to MacKendrick and Parkins (2004)*, 12,170 people, or 0.3% of the 2001 population of the province of British Columbia (3,868,875), reside in the Nadina Forest District (Tables 1 and 2). The Lakes TSA (6,785) has a larger population than the Morice TSA (5,385); however, Houston, located in the Morice TSA, is the most populous municipality with 3,575 residents. Approximately 6,200 residents live in the rural areas of the forest district. Most of these reside in the Lakes TSA (4,800), compared to the Morice TSA (1,400).

Table 1. Population Change in Nadina Forest District municipalities from 1991 to 2001.

	Burns Lake			Houston			Granisle		
	1991	1996	2001	1991	1996	2001	1991	1996	2001
Total population	1 585	1 760	1 900	3 625	3 935	3 575	800	440	350
% change	-	11.0	8.0	-	8.6	-9.1	-	-45.0	-20.5

(MacKendrick and Parkins 2004)

Table 2. Population change in B.C. and Nadina Forest District from 1991 to 2001.

	BC			Nadina Forest District			Lakes TSA			Morice TSA		
	1991	1996	2001	1991	1996	2001	1991	1996	2001	1991	1996	2001
Total population	3 247 505	3 689 755	3 868 875	11 640	12 150	12 170	6 005	6 710	6 785	5 630	5 435	5 385
% change	-	13.6	4.9	-	4.4	0.2	-	11.7	1.1	-	-3.5	-0.9

(MacKendrick and Parkins 2004)

Houston is known as the supply and distribution centre for the rural areas and smaller communities of the TSA. The town has a resource-based economy with strong agricultural roots and an economic base of forestry supplemented by mining (Brocklehurst 2001). With two of the province's ten most productive lumber mill operations (in terms of output capacity) located within or near the community, and the Huckleberry mining operation only 125 km away, forestry and mining directly and indirectly support a large share of the jobs and businesses in the community (Brocklehurst 2001). According to a recent

* MacKendrick and Parkins (2004) provide a detailed examination of a suite of indicators related to community sustainability in the Morice and Lakes IFPA region.

study, Houston's retail and service sectors are growing; they are benefiting from a combination of above-average incomes in the forest sector earned by many of its residents, local expenditures on goods and services by industries in the region, and tourist spending (HHCGL 2000). Tourism is also an important contributor to Houston's economy: the town promotes itself as the "Steelhead Capital of B.C." (Horn and Tamblyn 2000).

Also located within the Morice TSA is the considerably smaller community of Granisle, with a 2001 population of 350. Granisle experienced a 45% decrease in population between 1991 and 1996. The loss of some 357 people during this period is attributed to the closure of the Bell Mine in 1992, which had been the community's main employer (CMCL 1996). Although historically, the Morice TSA as a whole has been dependent upon forestry, Granisle has been dependent upon mining. The village is an example of the vulnerability associated with communities dependent on a sole sector of their economies for more than half of its employment: two mines operated in or near Granisle from 1971 to 1981; at present, there are no mining operations in the vicinity of Granisle, and its economy has become predominantly tourism and retirement-based, relying on outdoor recreation as the main attraction (CMCL 1996). The area relies heavily on the Babine Lake area to provide opportunities for tourism-based activities such as fishing and boating, hiking, hunting, camping, and wildlife viewing.

With 1,900 residents, Burns Lake is the largest and only incorporated community in the Lakes TSA, and the second largest community in the Nadina Forest District. It is the supply and distribution centre for a number of smaller rural communities situated along Highway 16 and in the area between Francois and Ootsa lakes (MSRM 2000), as residents of the Lakes TSA purchase most of their supplies and services in Burns Lake. In recent years, Burns Lake has been working to develop its tourism industry, promoting itself as "The Gateway to Tweedsmuir Park," which offers wilderness camping, boat anchorages, tent sites, and an extensive network of trails. Many businesses in Burns Lake's and other communities' in the study area cater to visitors taking part in those activities in the park (Petterson 2002). The population in the Lakes TSA rose steadily from 1991 to 2001. In contrast, the population of the Morice TSA decreased during the same period.

The Prince George Timber Supply Area (McGregor Model Forest)

In 2002, the McGregor Model Forest's geographic boundary was expanded from the area comprised in Tree Farm Licence 30 (an area of 181,000 ha) to include all of the Prince George Timber Supply Area (Prince George TSA) and associated parks and protected areas (MMFA 2004). The McGregor Model Forest now spans approximately 7.7 million hectares in the north-central interior of British Columbia. The geographic boundary is in many ways a virtual boundary, and provides the model forest with a focal point for determining locally relevant issues and priorities related to sustainable forest management, although it is not a jurisdictional boundary.

The corresponding Prince George TSA boundary encompasses the City of Prince George and the communities of Vanderhoof, Fort St. James, and Fraser Lake. (Hixon, Fort Fraser, Strathnaver, Giscombe, Upper Fraser, and Bear Lake are also part of the TSA.) Today, approximately 84% of the area's estimated 98,000 residents live in and around Prince George. There is a significant First Nations population—more than 6,140 people—and numerous reserves are located within the TSA boundaries (Figure 2; MMFA 2004; MSRM 2002).

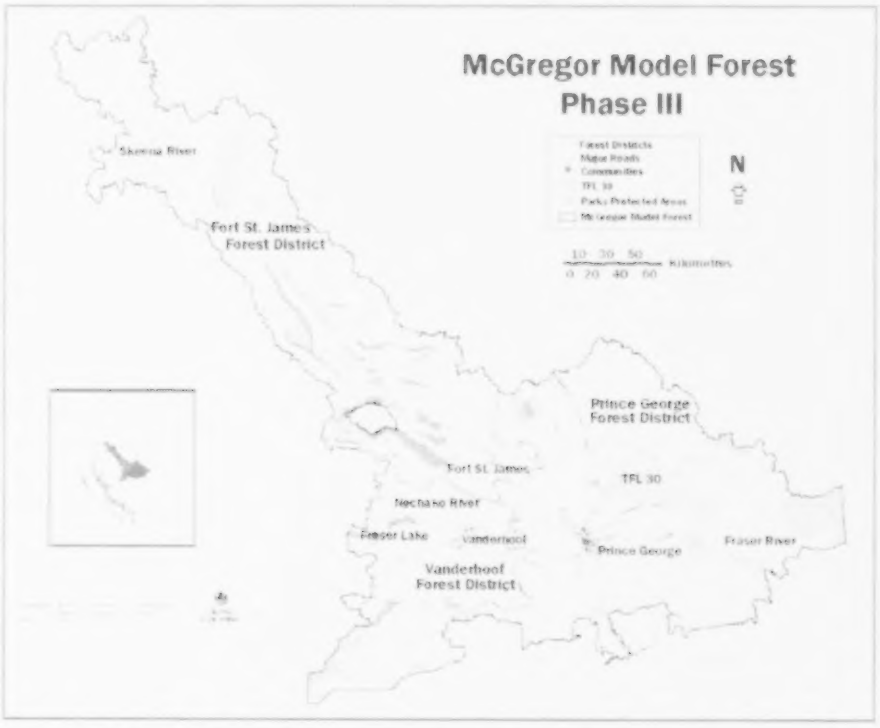

Figure 2. McGregor Model Forest's physical boundary, 2004.

The Prince George TSA also sits within a larger area of B.C. known as the Omeneca–Peace Region. Administration is divided among the Prince George, Vanderhoof, and Fort St. James forest districts. Prince George constitutes 44% of the TSA, Vanderhoof , 16%, and Fort St. James, 40% (BCMoF 1995). In reviewing the economic history of the TSA, the communities and economies within it will be considered.

Economic History

Forestry is the dominant resource sector and a major economic driver within the Prince George TSA (Deloitte and Touche Consulting Group 1996). However, a historical review of the Prince George TSA shows other interests and industries have been part of the economic growth of the TSA, many of which are still active and are becoming increasingly important in the region's economy today (Table 3).

Long before British explorers Alexander Mackenzie and Simon Fraser ventured into western Canada, the Carrier and Sekani First Nations tribes lived, occupied, and used the area. Carrier territory is generally associated with the lakes and river systems, particularly around Fort St. James, as these waterways support abundant salmon resources. Hunting and fishing was part of traditional life: using weirs and traps, the Carrier people fished for chinook and sockeye salmon, and they hunted game, caribou, deer, sheep, goats, grizzly bear, black bear, beaver, muskrat and rabbit for food and fur. Plants, including berries, pine cambium, bulbs, and shoots, were gathered for food and medicine (MSRM 1999a).

Fort St. James is the oldest community within the TSA; it is the oldest established community west of the Rocky Mountains (MSRM 1999a). Although it pales in size next to Prince George—the only 'city' within the Prince George TSA—Fort St. James was originally the administrative centre and economic hub of the northern fur trade in British Columbia (then called New Caledonia). It was founded in 1806 by Simon Fraser, on behalf of the North-West Company (later the Hudson's Bay Company), as the Stuart Lake fur trading post. Furs from other area trading posts that Fraser established, including Stoney Creek, Fraser

Lake and Fort Babine, were sent to Stuart Lake Post for accounting and then shipping to the east and on to Europe (MSRM 1999a).

In 1807, Fraser built an 83-mile road from Fort St. James to Fort McLeod—the first colonial-developed road in Carrier and Sekani territories (CSTC 2004). This opened up the west to the east and vice versa, and the economy and population of the west grew with the fur trade. Fraser also established Fort Fraser and Fort George fur trading posts in 1807, both of which are within the TSA today, and both of which benefited from the economic growth. These trading posts also formed part of the outline of a route in the race to build a railway across Canada.

By 1811, an alternate industry, albeit one less economically significant to the region than fur or forestry, began in the area: D. William Harmon was the first recorded farmer west of the Rocky Mountains in the Fort St. James area (CSTC 2004).

In the 1850s, when gold was discovered in the Omeneca region, which today constitutes part of Prince George TSA land, economic and social impacts in the region escalated. Thousands of prospectors and miners rushed into B.C., particularly the Fort St. James–Manson Creek area. As construction of roads and new transportation routes for miners began, improved access made some previously remote areas possible to reach. Community services developed, with hotels and boarding establishments in high demand. By 1871, B.C. had joined Canadian confederation, and the area now comprised in the Prince George TSA became part of Canada.

The abundance of spawning salmon in the TSA's many lakes and rivers meant fishing was an important source of revenue for local economies. In 1889, the federal fishing permit system was introduced, controlling how and where fishing could be undertaken, and marking the commencement of a formal fishing industry (MSRM 1999a).

Despite access problems, the gold rush and its riches continued to drive the economy and attract people to settle in the TSA into the early 20th century. In order to improve trade and access, the Skeena River steamship route was established: goods could be delivered from the Pacific Ocean as far as Hazelton, then transported by portage and canoe to Stuart Lake and into Fort St. James. Despite improvements, land access within the west remained a problem that hindered economic growth. The construction of the Grand Trunk Pacific Railway changed that and set the stage for development of a robust and efficient forestry industry—the industry that supports the area's economy today.

The first B.C. Forest Service office was established in 1913 near Prince George (now the Prince George Forest District) to take advantage of timber resources and the rail. The management area covered approximately 42% of the province's forested lands (CSTC 2004). The first timber sale for the area was 1.152 million board feet, and exceeded the timber volume of the entire province of Quebec. By 1927, 18 mills were operating in the region (CSTC 2004). With the bulk of the population of the Prince George TSA and an economy to match, Prince George has been colloquially referred to as the northern capital of B.C. ever since.

When the last spike was driven for the Grand Trunk Pacific railway in April, 1914, a race for frontier land commenced. Parts of the TSA were used for agriculture and ranching, particularly around Vanderhoof, which was along the railway survey line and was the closest post to suitable farming land. The town grew and, in 1926, Vanderhoof became the first agricultural settlement in the province. Fort Fraser and Fraser Lake developed as important agriculture and ranching areas soon after. Agricultural activity increased after World War I, due to land policies that provided veterans with homesteading land and an associated rise in lumber prices for construction. Agricultural activity increased again after World War II (MSRM 1999a).

With construction of the Kenney Dam in the 1950s and the generation of hydroelectric power, the population and economy grew further. The dam powered aluminum smelters in the province. By diverting water to these, the fertile Nechako valley was protected from floods, and further agricultural and ranching development was made possible along the river's banks (NVRCA 2004).

Mercury was discovered at Pinchi Lake in 1938, and until 1944 the Pinchi Lake mine was the only producer of mercury in Canada. Pressure for land from settlers and miners increased as silver and lead had also been discovered, and in 1936, two more economically significant infrastructure projects were

completed (CSTC 2004): the road into the operating mines of the Manson Creek Area, and the North Road, which remains a key access route through the area.

In the 1930s, the B.C. Ministry of Forests set up an office in Fort St. James. As demand for lumber increased in the 1940s and 50s, several locally owned sawmills were built. By the 1960s, many of these had amalgamated with larger companies into operations that still exist today.

The district of Mackenzie is an example of growth in forestry activity. Originally explored by Alexander Mackenzie in 1793, the town site was established only in the mid-1960s. It was set up to service large pulp- and lumber-manufacturing facilities. Forestry operations remain the primary economic driver of Mackenzie, but the town's location at the foot of the Rocky Mountains makes tourism an increasingly important revenue source.

The construction of the B.C. Rail–Dease Lake extension in the 1970s allowed timber harvest to move northward. In 1991, the rail was reopened, enabling access to the most northern part of the Fort St. James Forest District. This meant higher annual harvests, and confirmed forestry as the area's dominant economic activity (MSRM 1999a).

Also in 1991, spurred on by changing social and environmental values and the importance of forestry to local and national economies, the Government of Canada, through the Canadian Forest Service, established the Model Forest Program. The McGregor Model Forest Association was officially formed in 1992 and the McGregor Model Forest area (then known as TFL 30) was dedicated as part of phase II in 1997–98 (MMFA 2004).

The forest environment within the Prince George TSA is diverse. Today, this diversity is reflected in a range of resource uses, with forestry as the dominant use. Other uses include hunting, trapping, fishing, recreation (hiking, skiing, trail riding, snowmobiling, caving, etc.), tourism, and agriculture (Deloitte and Touche Consulting 1996). In addition, the area's location along the route to Alaska, traffic from the Prince Rupert ferry, and VIA Rail passage contribute to tourism exposure and economic growth within the region.

Table 3. Key elements of the Prince George Timber Supply Area's economy through its history.

Carrier and Sekani tribes: fishing, hunting and use of existing vegetation
Fur trade, Hudson Bay Company
Agriculture and ranching in Vanderhoof
Gold rush and gold mining
Access infrastructure brought about by the above
First Forest Service established (1913)
Large timber sale 1914, onward
Fishing (salmon: chinook and sockeye)
Railways: Grand Trunk Pacific/ Canadian National Railway, and VIA Rail
Silver, lead, and mercury mining
Mineral deposits and opportunities
Agricultural leases policy
Diversification through tourism and recreation

Major Communities

According to Statistics Canada (2001), 102,170 people, or 2.6% of the 2001 population of the province of B.C. (3,868,875) reside in the Prince George TSA. Prince George is the sole city within the timber supply area, and comprises most of the regional population with a reported 2001 population of 71,990. Prince George is the supply and distribution centre for the rural areas and the smaller communities of the region. The city is largely resource based, with strong agricultural roots and an economic base of forestry supplemented by mining.

Both Prince George and the TSA experienced population growth between 1991 and 1996, at 7.8% and 9.1%, respectively. Although the province grew between 1996 and 2001 at a rate of 4.9%, Prince George and the Prince George TSA experienced –3.7% and –3.4% respective decreases in population (Table 4).

Table 4. Population change in B.C., the Prince George TSA, and Prince George from 1991 to 2001.

	B.C.			Prince George TSA			Prince George		
	1991	1996	2001	1991	1996	2001	1991	1996	2001
Total Population	3 247 505	3 689 755	3 868 875	96 930	105 795	102 170	69 315	74 730	71 990
% Change	-	13.6	4.9	-	9.1	-3.4	-	7.8	-3.7

(Statistics Canada 2001)

Table 5 shows that Vanderhoof is the second largest town in the TSA, with 4,320 reported residents. Vanderhoof is followed by Fort St. James (1,935 residents) and Fraser Lake (1,270 residents) in population size. The region's remaining 22,655 residents are located in the smaller towns and rural area surrounding the major towns.

Vanderhoof, Fort St. James, Fraser Lake, and rural areas experienced population growth from 1991 to 1996. The rural part of the Prince George TSA experienced the highest population growth rate from 1991 to 1996, at 14.7%. Vanderhoof experienced the next highest population growth rate at 9.4%. Fort St. James and Fraser Lake experienced low growth rates of 2.2% and 3.5%. The three communities and their surrounding rural areas then experienced population declines from 1996 to 2001. Fort St. James and Fraser Lake experienced the greatest population loss: 5.8% and 5.6%, respectively. Rural Prince George TSA experienced the next greatest population decline at 2.8%. Vanderhoof remained relatively stable with a population decline of 0.9%.

Table 5. Population change in other Prince George TSA communities from 1991 to 2001.

	Fort St. James			Fraser Lake			Vanderhoof			Rest of Prince George TSA		
	1991	1996	2001	1991	1996	2001	1991	1996	2001	1991	1996	2001
Total Population	2 010	2 055	1 935	1 300	1 345	1 270	3 985	4 360	4 320	20 320	23 305	22 655
% Change	-	2.2	-5.8	-	3.5	-5.6	-	9.4	-0.9	-	14.7	-2.8

(Statistics Canada 2001)

Economic Indicators

Today, many people in the study area lead rural lifestyles that include combinations of logging, mixed farming, and ranching. The economy of the area was built on the forest resource and, although diversification into other sectors has occurred over the years, dependency on the forest industry remains high. The following sections provide baseline information with respect to several macroeconomic indicators of the state of the economy in the region. Regional economic indicators used in this report consist of revenue, net regional product, royalties and indirect taxes, labour income, and employment. Table 6 explains each indicator.

Table 6. Summary of economic indicators used in the overview.

Indicator	Explanation
Revenue	The gross amount of economic activity (in dollars) that takes place in the region on an annual basis. Revenue is the product of quantity and price in an economic market (for example, revenue is the total value of sales).
Net regional product (NRP)	The combination of all dollar payments for labour, capital, resource rents, and indirect taxes (for example, net regional product is the amount of "value-added" activity). Unlike revenue, net regional product represents the value of goods and services produced in the region in a year.
Royalties & indirect taxes	The dollar rents paid by firms to the government for use of publicly owned natural resources. Indirect taxes are any taxes other than income or corporate.
Labour income	The dollar amount paid by firms to employees (for example, salaries, wages, etc.)
Employment	The number of individuals who associate their job in an individual industry as their primary source of employment.

Data and Methodology

Regional industries have been aggregated into six major sectors of interest: agriculture, forestry, retail, visitor, public, and the rest of the economy. Where possible, indicators are reported for each major sector. An explanation of the major sector aggregation is located in Table 7.

Table 7. Summary of major sectors in the study regions.

Sector	Explanation
Agriculture	All agriculture (e.g. farming) and agriculture-related services (e.g. veterinary services)
Forestry	Logging, milling, and forestry-related services
Services	Domestic service expenditures on non-industry specific services by residents and local businesses. Industry-specific services are included under the specific sector being served. For example, forestry services are included in the forestry section.
Visitor*	Economic activity related to people visiting the region for the purpose of tourism, business, conventions, etc. The visitor sector is a distinct separation of visitor from domestic expenditures on accommodations, retail, transportation, and services.
Public	Education, social services, health, and government services.
Rest of the Economy (ROE) **	All remaining sectors of the economy, including retail, mining, construction, transportation, warehousing, etc.

* The many recreational opportunities attract a significant number of visitors each year, including regional visitors, visitors from the rest of the province, and long-haul visitors from North America, Europe, and Asia. Although accurate and timely information on the size and value of tourism in the study area is not available, Tourism BC (1998) produced a report entitled, *B.C. Visitor Study: Report on Travel In British Columbia--Northwest Region*, that summarizes travel patterns between 1995 and 1996. The northwest region, within which the study region lies, includes all areas north of the Highway 16 corridor between the Alberta border and the Queen Charlotte Islands. As the figures reported reflect a much larger geographic area than our study area, the information must be interpreted with some caution. Regardless of this issue, the report was an exhaustive attempt to measure the volume and value of travel in the province, and is the best source available.

** Mining is aggregated with the retail sector due to confidentiality constraints.

A mixed-methods, or hybrid, data collection approach was adopted in order to overcome limited availability of regional-level data. The hybrid approach uses both primary and secondary data collection techniques. Secondary data exist in the form of a Statistics Canada custom census profile for the Nadina Forest District (years 2001, 1996, and 1991), the 1999 British Columbia Input–Output Tables (Statistics Canada 2003), and previous reports. Primary industry data were collected by surveying businesses in the study areas. Respondents were asked to provide information regarding personal employment history, business revenue and expenditures, business employment, and business wage bill. The hybrid data, derived from secondary data and surveys, were used to create region-specific economic databases for the study areas. For the purpose of monitoring, the database should be updated every five years, following census updates.

Regional Economic Databases

The creation of a region-specific economic database for each study area follows the methodology reported by Patriquin et al. (2002). This hybrid approach involves a series of steps starting with provincial input–output tables—set of three tables that detail the annual transactions in, and structure of, a market economy—a base. The tables are then transformed into a social accounting matrix (SAM; a double-entry, square accounting framework that ensures data consistency when using hybrid sources). The SAM provincial database, is then mathematically regionalized using location quotients (the proportion of regional employment divided by the proportion of provincial employment for each sector). This step results in a preliminary region-specific SAM. Superior (primary) data is then inserted through a process of selective precision, which involves choosing the major sectors of interest and focusing primary data collection efforts. Data consistency is crosschecked with secondary sources throughout the process.

The resulting economic databases are snapshots of economic activity and as such, they are best considered to be "on average" representations of the economy. For example, the provincial SAM is based on the 1999 economic structure of the province, the most recent available. Secondary data on employment and income is derived from a 2001 custom census profile by Statistics Canada. Finally, primary data is based on 2002 activity. As a result, the region-specific economic database should be considered as an annual average of the period, 1999 to 2002. For the purpose of this analysis, the regional economic databases are tied to the 2001–02, pre-increase annual allowable cut reported for the timber supply areas of the Northern Interior Forest Region.

Sector Profiles

Nadina Forest District Region

Sector Backgrounds

Agriculture

The agriculture sector has played an important role in the area's economy since the late 1800s. Primary crops included oats, barley, cabbage, turnips, potatoes, cauliflower, and hay (Hols 1999). Beef and dairy production were also a vital part of life in the area. However, since 1970, the contribution of the agriculture sector has decreased. Today, due to the very short growing season, cattle ranching is the primary agricultural enterprise in the Nadina Forest District. However, the cattle industry all across Canada has suffered recently due to trade restrictions resulting from cases of Bovine Spongiform Encephalitis (Mad Cow disease). A few vegetable and small commercial horticultural operations are also located in the study area (Horn and Tamblyn 2000).

Most agricultural activity in the Lakes TSA occurs in the mid-district area, bounded by Ootsa and Cheslatta lakes to the south, and the Bulkley and Endako river valleys to the north. Most of the arable land, which is rated as Class 5 or better in the Canada Land Inventory, in the district is found in this area, and is typically associated with lakeshores, river valleys, and the Grassy Plains area between Francois and Ootsa lakes. The most productive arable soils in the mid-district area are generally privately owned and are used to produce forage crops. Southbank, Grassy Plains, Wistaria, Takysie, Cheslatta, Ootsa Palling, Colleymount, and Noralee are small rural communities in the Lakes TSA. This area is home to approximately 2,000 people.

Total capacity of the Morice Stock Range is estimated to be 27,273 animal unit months* (AUMs). In 1993, 10,867 AUMs of forage were authorized for use by livestock (9,204 AUMs in 10-year grazing licenses and 1,188 AUMs in five-year grazing permits) and 8,908 AUMs were consumed by 3,491 head of cattle and horses in the Morice TSA. In 1999, the amount of AUMs allocated to grazing tenures increased to 12,000 (Horn and Tamblyn 2000) and, at present, the Morice TSA supports 4,000 animals, consisting primarily of cattle, with a small percentage of horses (Horn and Tamblyn 2000). According to a 1992 study on the beef industry in B.C., the Bulkley Valley is one of the few places in the province that can support an expanded beef industry (CMCL 1996). However, slow growth is predicted for this sector, in the short term because of market conditions, and in the long term because of climatic and biophysical constraints (Government of British Columbia 2001). There is also recent history of land-use conflict where areas of higher soil capability intersect with ungulate winter range and as proposals for agricultural expansion have begun to conflict with existing forest development (MSRM 2000).

There are between 65 and 80 beef cattle and forage operations in the Lakes TSA. Most operations depend on crown rangelands for grazing during summer and fall. Agriculture does, however, provide full-time and supplementary employment to many people, and is a source of economic diversity for the region (MSRM 2000).

Forestry

As of 2002, about 64% of the Morice TSA (961,000 ha) is considered productive forest area managed by the Crown. About 71% of this is considered available for timber harvesting under current forest management practices (BCMoF 2001). As of 2001, approximately 66% (745,000 ha) of the 1.2 million hectares that comprise the Lakes TSA is productive forest and, of this, approximately 66% is considered available for timber production and harvesting (BCMoF 2002a). The Lakes TSA annual allowable cut was increased in 2001 to 2.96 million m^3 as part of mountain pine beetle epidemic management. As such, nearly 1.46 million additional cubic metres need to be administered.

When these estimates are combined to account for the entire Nadina Forest District study area, 35% (918,097 ha) of the total area (2,624,901 ha) is either privately owned, non-forested, or allocated to agricultural leases (Figure 3). Sixteen percent (432,853 ha), most of which is environmentally sensitive or of low productivity, has been removed from the calculation of productive forest. This leaves a total of 1,273,950 hectares, nearly half of the total area considered available for timber harvesting (BCMoF 2001, 2002a).

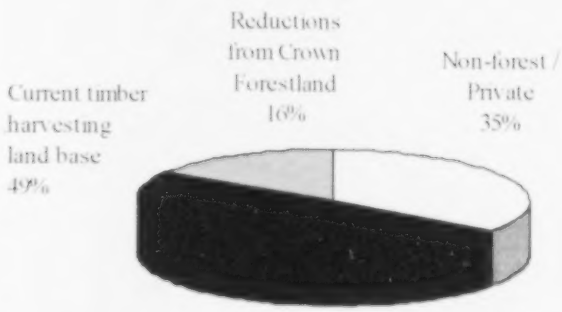

Figure 3. Timber availability on the Nadina Forest District land base.

Table 8 displays the distribution of the Northern Interior Forest Region's total annual allowable cut (AAC) by TSA as of June, 2003. The annual allowable cut is the allowable rate of timber harvest from a specified area of land. The chief forester sets annual allowable cuts for TSAs and tree farm licenses (TFLs) in accordance with Section 7 of the *Forest Act*. Together, the Lakes and Morice TSAs account for 17% of the forest region's AAC. The Lakes AAC was initially 1,500,000 m^3 per year and the new volume reported

* One AUM is equivalent to the amount of forage required by one adult cow or horse for one month. Sheep forage requirements are one quarter of this amount.

in Table 8 reflects the increase granted to address mountain pine beetle forest damage. For the purpose of this analysis, we are assuming that the pre-increase AAC of 1,500,000 m^3 will be the most closely associated to the area's economic database.

Table 8. Northern Interior Forest Region's annual allowable cut.

TSA	AAC m^3/yr	% of total
Bulkley	882 000	3%
Cassiar	305 000	1%
Cranberry	110 000	0%
Dawson Creek	1 860 000	6%
Fort Nelson	1 500 000	5%
Fort St. John	2 115 000	7%
Kalum	436 884	1%
Kispiox	977 000	3%
Lakes	**2 962 000**	**10%**
MacKenzie	3,050 000	10%
Morice	**1 961 117**	**7%**
Nass	865 000	3%
Prince George	12 244 000	42%
Total	**29 268 001**	**100%**

(BCMoF 2003)

Each TSA's AAC is distributed by the B.C. Ministry of Forests among timber tenures in accordance with Section 8 of the *Forest Act*. The distribution is termed AAC apportionment. Currently, 80% of the study area's available timber volume is allocated to forest licenses, 17.2% to the Small Business Forest Enterprise Program (SBFEP), and 1.7% has been set aside for potential expansion of the Woodlot License Program (Table 9). On April 1, 2003, the SBFEP was replaced by B.C. Timber Sales.

The remaining AAC is distributed among replaceable timber sale licenses, community forest agreements, and the forest service reserve. Notice that the full AAC of each TSA has not been allocated to agreements. Table 10, which displays the AAC by commitment, shows that CANFOR, West Fraser Mills Ltd., and Babine Forest Products Ltd., are the three largest license holders in the study area, comprising 36%, 35%, and 13% of the total AAC, respectively.

Table 9. AAC by form of agreement.

Timber disposition	Morice		Lakes		Morice and Lakes	
	AAC (m^3)	Proportion of AAC	AAC (m^3)	Proportion of AAC	AAC (m^3)	Proportion of AAC
Forest licences	1 778 380	89.6%	1 008 850	67.3%	2 787 230	80.0%
TSL	0	0%	1 795	0.1%	1 795	0.1%
SBFEP	184 870	9.3%	413 078	27.5%	597 948	17.2%
• Any	0	0%	52 000	3.5%	52 000	1.5%
• Category 1	65 020	3.3%	167 692	11.2%	232 712	6.7%
• Category 2	11 270	0.6%	35 586	2.4%	46 856	1.3%
• Bid proposals	108 580	5.5%	157 800	10.5%	266 380	7.6%
Woodlot license	5 815	0.3%	52 600	3.5%	58 415	1.7%
Community forest agreement	0	0%	23 677	1.6%	23 677	0.7%
Forest service	16 750	0.8%	0	0%	16 750	0.5%
Total	1 985 815	100%	1 500 000	100%	3 485 815	100%

(BCMoF 2003)

Table 10. Distribution of Nadina Forest District AAC by commitment.

	Form of Agreement	Current licensee	Volume (m^3)	Proportion of Nadina Forest District's total commitments
Lakes	Forest licenses (replaceable)	L&M Lumber Ltd.	23 084	0.75%
		Babine Forest Products Ltd.	431 518	13.23%
		Canadian Forest Products Ltd. (CANFOR)	53 627	1.73%
		Babine Timber Limited	130 605	4.01%
		West Fraser Mills Ltd.	367 194	11.85%
		Total	1 006 028	31.57%
	Forest licenses (non-replaceable)	Tahtsa Timber Ltd.	150 000	4.84%
		Cheslatta Forest Products Ltd.	25 000	
	TSL<=10000 m^3 (replaceable)	Anderson, Sivert	399	0.01%
		519709 B.C. Ltd.	323	0.01%
		Payne, Kenneth	826	0.03%
		Total	1 548	0.05%
	SBFEP forest licenses (non-replaceable)	Cheslatta Forest Products Ltd.	100 000	3.23%
		Burnslake Specialty Wood Ltd. (BSW)	90 000	2.91%
		Total	190 000	6.13%
	Total commitments		1 347 576	42.59%
Morice	Forest licenses (replaceable)	Houston Forest Products (Weldwood and West Fraser Mills Ltd)	713 896	23.04%
		Canadian Forest Products Ltd. (CANFOR)	1 064 484	34.36%
		Total	1 778 380	57.41%
	Total commitments		1 778 380	57.41%
	Total commitments in the Nadina Forest District		3 097 850	100%

(BCMoF 2003)

Currently, the forest industry is the main economic driver in this region. During the past few decades, the area's forest industry has seen major change, including consolidation of small-scale sawmill operations into large-scale, centrally located wood-processing facilities. The production of lumber has also increased as a result of substantial increases in harvest rates in the 1960s and 1970s. Furthermore, wages, benefits, and working conditions have also improved in timber-processing facilities (MSRM 2000).

In the Lakes TSA, Decker Lake Forest Products Ltd., began operation in 1968, but was bought in 1995 by Babine Forest Products Ltd., which began operating in the area in 1975 (CMFS 2000). Also in the late 1960s, Noranda (Northwood) purchased a failed integrated forest products complex in the Morice TSA from Bulkley Valley Forest Industries and developed the sawmill aspect of the business (Horn and Tamblyn 2000). In 1999, ownership was transferred to Canadian Forest Products Ltd., and today it is the world's largest sawmill. In 1978, Weldwood of Canada Ltd., and Eurocan Pulp and Paper Co., established a second major sawmill in the Morice area under a joint venture of Houston Forest Products Co. (Pettersen 2002). Today, Houston Forest Products is the fourth largest sawmill in B.C. Both of the Morice mills are among the province's ten most productive lumber mill operations in terms of output capacity.

Domestic Services

There are 326 service businesses in the region, with 190 located in the Morice TSA and 136 located in the Lakes TSA. Of these, 108 provide hospitality services in the region; the majority of the economic contribution of the hospitality services is included in the visitor sector analysis. Approximately 174 firms supply predominantly domestic services such as financial services, realty, insurance, beauty salons, and automotive services.

Public

The Nadina Forest District falls within the Bulkley–Nechako Regional District. Municipalities in the regional district include Houston, Granisle, Burns Lake, Fort St James, Fraser Lake, Smithers, Telkwa, and Vanderhoof. Table 11 shows the breakdown of employment by industry. The social industry, which comprises educational service industries (including colleges) and health and social service industries (including private-practice dentists), supports the largest number of employment positions and contributes the largest share of income in the government sector.

Table 11. Employment and income statistics for the public sector.

	Employees 2001			Employees 1996		
Community or Area	General	Social	Utilities	General	Social	Utilities
Houston	115	195	10	70	200	0
Burns Lake	85	200	0	35	165	10
Granisle	10	20	0	40	30	0
Total Morice	125	285	0	124	366	0
Total Lakes	250	580	15	136	455	10
Nadina Forest District Study Area	375	865	15	260	821	10

(Statistics Canada 2001)

The employment estimate for the Lakes TSA is considerably lower than the 2000 estimate, which stated that more than 700 employees work in the Lakes TSA's 22 schools, five adult centers, three alternative education sites, and an Internet-based instruction program (MSRM 2000). Most of the employment gains during the last 20 years have been in government services, health, and social services.

A recent survey conducted by Urban Systems (2001) found that government services account for more than 95 full-time-equivalent jobs in Houston. The two largest employers in the sector are the B.C. Ministry of Forests, which has a district office with 55 full-time-equivalent jobs, and the District of Houston, with 20 full-time-equivalent positions. Nevertheless, the Urban Systems (2001) study and the 2001 Statistics Canada census data do not reflect recent cutbacks in government services in the region, including closure of the B.C. Ministry of Forests office in Houston. Current data is presently unavailable. Public and

institutional services in Houston include the secondary school, elementary schools, community churches that serve several denominations, a medical clinic, a satellite post-secondary institution, a library, government buildings such as Municipal Hall, an ice arena, a curling rink, and public utilities.

Visitor

Using the Wellstead et al. (2000) methodology of using the term, "visitors," which includes not only "tourists" but also those traveling for business and personal reasons, more than two million travelers visited the Northwest Region in 1995 and 1996, spending $425 million. About 12% of travelers visited the Lakes TSA, including 160,600 B.C. residents and 100,810 non-residents, although nearly double (22%) visited the Bulkley–Nechako region, which includes Houston (256,960 B.C. residents and 225,340 non-residents). Travelers spent approximately $52.2 million in the Lakes TSA and $98.6 million in the Bulkley–Nechako region. Average expenditures per person per day, including both B.C. residents and non-residents, were $54. The average expenditure per trip was $178 by B.C. residents, who stayed an average of 3.4 days, and $234 by non-residents, who stayed an average of 4.4 days.

The B.C. Visitor Study for the Northwest Region (1998) confirms that outdoor wilderness activities are a primary reason for visiting Northwest B.C., with fishing, boating, and hunting being major tourism and outdoor recreation activities. Studies also indicate a trend toward increased backcountry and eco-tourism (e.g., wilderness travel, wildlife viewing) in the region (TCS 2000a).

The local tourism industry is based largely on part-time and seasonal ventures that capitalize on the area's natural resources. A number of businesses belonging to the recreational service industry, such as small resorts, campsites, guide–outfitters, and related businesses, generate a small but significant amount of employment and income in the area. Visitors also create employment positions in the accommodation and food and beverage service industries. These industries combined make up the hospitality industry (refer to Table 12). The hospitality industry is primarily dedicated to tourists; however, other industries, including the retail and service sectors, also benefit from outside visitors. It appears that the hospitality-based employment is split fairly evenly between the Morice TSA and the Lakes TSA.

Table 12. Employment and income statistics for the hospitality industry.

Community or Area	Employees	Average Annual Income
Houston	205	$1 886 405
Burns Lake	80	$966 000
Morice TSA	291	$2 836 696
Lakes TSA	237	$1 179 808
Study Area	528	$4 016 505

(Statistics Canada 1996)

The Houston Snowmobile Club maintains groomed trails in the area. The club has strong support from the local chamber of commerce, which helps to promote the activity. According to club land-use officer Les Auston (TCS 2000a), as many as 150 to 200 snowmobiles are being driven in the Telkwa Range area on a sunny weekend in the spring. Many of the snowmobilers are from the Prince George and Vanderhoof areas, promising markets for Houston (TCS 2000a). The Houston Snowmobile Club has 125 members and estimates an average of 5,000 users per year, 40% of which are out-of-town visitors.

Although snowmobilers and cross-country skiers have resolved shared use of Morice Mountain, there is potential conflict in more remote areas between backcountry skiing and snowmobile use (Horn and Tamblyn 2000). There are also land-use issues in the Telkwa Range area involving the Telkwa caribou herd, and the Houston Snowmobile Club and other area users. According to the club, closure in the Telkwa Range would affect tourism in the Houston area, because this area has the most popular snowmobiling trails in the club's system of trails. Lack of accommodation has been listed as another weakness (TCS 2000a).

Hunting is an important recreational pursuit in the study area. Residents of B.C. comprise the largest share of hunter days. There are 15 guide–outfitting territories and 12 lodges, resorts, and guest ranches operating in the Lakes TSA (Government of British Columbia 2001). There are nine guide–outfitting territories that overlap the Morice TSA. Clients are drawn to the area by the potential for abundant game

in a remote wilderness setting (Horn and Tamblyn 2000). Moose and bear are most often sought by guided hunters, averaging 1,008 and 615 hunt days per year between 1989 and 1998 (Horn and Tamblyn 2000).

Many outfitters operate on a part-time basis, supplementing income from other sources such as ranching or forestry (CMCL 1996). Six guide–outfitters operate in the Houston area and most of their clients (~80%, according to the Morice TSA analysis in BCMoF 2001) come from the U.S., and place high value on untouched wilderness. For the northwest section of the province where there are 65 active guides, total economic impact of hunting amounts to $8.1 million and 170 jobs (CMCL 1996). A rough calculation for the Morice TSA using 10 to 20 percent of this figure would result in approximately $810,000 and $1.6 million dollars in total revenue being generated by guide–outfitter activity in the Morice area (CMCL 1996).

Trapping provides seasonal income to 90 licensed trappers in the Lakes TSA (MSRM 2000). There are approximately 128 official traplines located within the Morice TSA, for each of which there are several registered trappers, although actual amounts are not readily available (CMCL 1996). Sixty-two trapping territories overlap the Morice Land and Resource Management Plan area (Horn and Tamblyn 2000). The number of active trappers is unknown, as many trap lines may be inactive.

Rest of the Economy

The rest of the economy in the region includes mainly the retail and mining sectors. The retail sector in the region is of moderate size. A total of 226 retail firms exist in the region, split fairly evenly between the two districts, with 111 firms (49%) in the Lakes TSA and 115 firms (51%) in the Morice TSA. Approximately 88, or 39%, of these firms consist of construction and construction-related contractors. The Lakes TSA accounts for 45 (51%) retail construction firms, with the remaining 43 (49%) located within the Morice TSA. The remaining 138, or 61%, of existing general retails firms consist of clothing stores, electronics (including computers), hardware, sporting goods stores, fuel sales, and grocery stores. The Lakes TSA contains 66 (48%) general retail firms, and the Morice TSA contains 72 (52%) general retail firms.

Mining was once a thriving industry in the study area, with mines operating for copper, molybdenum, silver, gold, and zinc. Several small mines operated in the Lakes TSA and a number of important mines operated in the Morice TSA during the last 20 years, including Bell Copper, Granisle, Equity Silver, Dome Mountain, and Nadina Silver. Last to close were the Bell Copper Mine, near Granisle, which ran from 1972 to 1992, and the Equity Silver Mine, near Houston, which ran from 1981 to 1994, and employed 57% and 10% of the 1991 labour forces in Granisle and Houston, respectively (CMCL 1996). Mining remains one of the greatest industries for potential regional economic growth.

In 1997, the mining industry was revived when the Huckleberry Mine, an open-pit porphyry–copper mining operation located 125 kilometres southwest of Houston, began operations. Imperial Metals Corporation, the head office of which is in Vancouver, and Japan Group (a consortium comprised of Mitsubishi Materials Corporation, Marubeni Corporation, Dowa Mining Co. Ltd., and Furukawa Co. Ltd.) each have a 50% interest in the mine, but it is operated by Imperial. The property consists of a mining lease covering approximately 1,911 hectares and nine mineral claims consisting of a total of 73 units that encompass approximately 1,825 hectares.

Mining is done with standard open-pit truck and shovel equipment, and an average of 21,000 tonnes of ore is processed per day through a semi-autogenous grinding–ball mill circuit to produce copper concentrate and molybdenum concentrate. The copper concentrate is trucked to Stewart for shipment to Japan; the molybdenum concentrate is trucked to and sold in Vancouver (Table 13). Exploration in the vicinity of the mine continues, and it is possible that mine life may be extended if additional reserves are found. Mine life may also be extended if copper prices increase, making it feasible to mine marginal reserves (HHCGL 2000).

The mine directly employs 175 people, with several additional full-time jobs being created by contractors who work directly for the mine. One estimate suggests that the mine generates about 40 indirect jobs. It is serviced mainly out of Houston (Horn and Tamblyn 2000).

Table 13. Mining production statistics.

	Years ending December 31		Nine months ended September 30, 2002
	2000	2001	
Ore milled (tonnes)	7 145 600	7 415 866	5 397 507
Ore milled per calendar day (tonnes)	19 523	20 317	19 771
Ore milled per operating day (tonnes)	21 337	21 732	21 209
Grade (%): Copper	0.502	0.522	0.531
Grade (%): Molybdenum	0.013	0.016	0.015
Recovery (%): Copper	93.3	94	88.66
Recovery (%): Molybdenum	63.7	73.3	51.6
Copper produced (lbs)	73 831 000	80 242 322	55 977 127
Molybdenum produced (lbs)	13 14 662	1 958 544	900 905

(Imperial Minerals Corporation 2003)

In addition to the Huckleberry Mine, jobs are provided by the clean up and reclamation associated with mine closures, as well as exploration of mines. Despite low metal prices, from 1994 to 1999, more than $9 million dollars were spent on mineral exploration within the Morice TSA (Horn and Tamblyn 2000). Recent discoveries of gold and silver, and advanced exploration on a molybdenum deposit in the northern tip of the district indicate future potential for mineral exploration and development. Highly significant metallic mineral deposits are also found in portions of the former Tweedsmuir Recreation Area and defined mineral resources remain at Bell, Dome, and Nadina mines (CMCL 1996). There are prospects, with defined resources, that are currently dormant, but which could be revived either by higher metal prices, or by new exploration that expands the resource.

Moderate oil and gas potential exists in a strip along the southeastern portion of the Morice Land and Resource Management Plan area (Horn and Tamblyn 2000). This territory represents the northwestern edge of the Nechako Basin. The potential of the Nechako Basin–Quesnel Trough has been estimated at 8.1×10^{8} m^3 (5.1 billion barrels) of oil, and 2.7×10^{11} m^3 (9.5 trillion cubic feet) of gas (Hannigan et al. 1994). Proximity to a major gas transmission pipeline that runs between Fort St. John and Prince Rupert increases the economic value of the hydrocarbons in the vicinity of Highway 16 (Horn and Tamblyn 2000).

Indicator Summary

The economic impacts of each sector within the Nadina Forest District are summarized, according to the economic indicators selected for the study, in Table 14.

Table 14. Baseline economic data for the Nadina Forest District.

Sector	Nadina Forest District		B.C.	
	Gross revenue ($M)	% of total	Gross revenue ($M)	% of total
Agriculture	5.4	0.5	5 540.1	1.9
Forestry	508.8	47.6	17 623.7	6.1
Service	13.4	1.3	141 137.4	49.1
Public	61.4	5.7	37 687.7	13.1
Visitor	133.9	12.5	13 573.5	4.7
Rest of the economy	346.2	32.4	71 949.7	25.0
Total	1 069.3	100.0	287 512.2	100.0
	Net regional product ($M)	% of total	Net regional product ($M)	% of total
Agriculture	1.5	0.4	1 819.9	1.6
Forestry	240.0	59.5	7 999.1	7.2
Service	9.6	2.4	54 129.1	49.0
Public	36.6	9.1	22 535.6	20.4
Visitor	34.0	8.4	5 586.2	5.1
Rest of the economy	81.8	20.3	18 414.2	16.7
Total	403.6	100.0	110 484.2	100.0
	Royalties and indirect taxes ($M)	% of total	Royalties and indirect taxes ($M)	% of total
Agriculture	0.6	0.6	598.7	2.3
Forestry	88.3	83.7	2 453.5	9.4
Service	1.7	1.7	18 386.3	70.2
Public	6.9	6.6	1 732.0	6.6
Visitor	2.8	2.7	703.1	2.7
Rest of the economy	5.1	4.8	2 304.4	8.8
Total	105.5	100.0	26 178.0	100.0
	Gross wages ($M)	% of total	Gross wages ($M)	% of total
Agriculture	0.7	0.3	625.6	1.1
Forestry	113.5	49.0	4 191.7	7.3
Service	7.6	3.3	18 127.8	31.5
Public	24.2	10.4	18 319.9	31.8
Visitor	25.0	10.8	4 414.4	7.7
Rest of the economy	60.8	26.2	11 921.9	20.7
Total	231.7	100.0	57 601.3	100.0
	# of employment positions	% of total	# of employment positions	% of total
Agriculture	190	1.9	85 080	4.2
Forestry	2 495	24.5	98 280	4.9
Service	816	8.0	502 240	24.9
Public	865	8.5	470 750	23.4
Visitor	2 262	22.2	256 400	12.7
Rest of the economy	3 549	34.9	601 860	29.9
Total	10 178	100.0	2 014 610	100.0

Revenue

Agriculture-related services account for about $5.4 million of the region's gross revenue. This represents approximately 0.5% of the total amount of economic activity generated in the region. Comparatively, the agriculture sector is more predominant in the province, contributing approximately $5.5 billion, or 1.9%, of total gross revenue. Although agriculture is the smallest sector in terms of revenue, it represents a potential area for economic diversification.

Forestry-related services represent the single largest sector in the Nadina Forest District. Forestry generates an estimated $508.8 million in gross revenue, or 47.6% of total revenue in the region. In the province, forestry generates a total of $17.6 billion in revenue. However, forestry proportionally contributes less to total revenue in the province (6.1%) compared to the amount contributed to the region (47.6%).

The service sector contributes an estimated $13.4 million of gross revenue to the regional economy. This represents 1.3% of the total revenue generated from all sectors. The domestic service sector is the second smallest contributor to the regional economy in terms of revenue. The regional service sector is less developed than the provincial service sector: in the provincial economy, the service sector is the second largest, next only to the aggregate 'rest of the economy' sector. The service sector accounts for $141.1 billion, or 49.1% of provincial revenue.

The public sector is under-represented in terms of revenue generation in the region, compared to the provincial average. The public sector produces an estimated $61.4 million in regional revenue. This accounts for 5.7% of revenue generation activities in the region's economy. The public sector totals $37.7 billion province wide, representing 13.1% of all sector activity.

The visitor sector accounts for $133.9 million of gross revenue in the Nadina Forest District, representing 12.5% of the total gross revenue generated. This is higher than the percent contribution of the visitor sector in the province, which equals 4.7% ($13.6 billion). Next to forestry and the combined 'rest of the economy' sectors, the visitor sector accounts for largest percent contribution to regional revenue.

The rest of the economy accounts for an estimated $346.2 million of gross revenue in the region, or 32.4% of the total revenue derived from regional economic activity. This sector accounts for $71.9 billion of gross revenue, or 25.0% provincially.

Net Regional Product (NRP)

The agriculture sector generates an estimated $1.5 million of net regional product (value-added) in the region. This represents 0.4% of the entire net regional product generated from the regional economy. The provincial agriculture sector generates $1.8 billion (1.6%) for the entire province. Similar to gross revenue, the agriculture sector currently makes the smallest contribution to NRP. This relationship also holds true in the overall provincial economy. The percent contribution of agriculture to NRP in both the Nadina Forest District and BC is slightly lower for NRP than it is for gross revenue. This suggests that agriculture is not as value-added intensive as some of the other major sectors.

Forestry accounts for an estimated $240.0 million of net regional product, representing 59.5% of the total value-added generated in the region. Comparatively, forestry generates $8.0 billion, or 7.2% of NRP in the province. The forestry sector has a large proportional contribution to NRP compared to other sectors. This relationship is very strong in the region, suggesting high factor payments to labour, land, and capital. This is also a reflection of the high forest productivity in the region.

The service sector generates an estimated $9.6 million in NRP. This accounts for 2.4% of all NRP generated in the forest district. In the province, the service sector accounts for $54.1 billion, 49.0% of provincial NRP. Proportionally, the region's service sector contributes more than average to NRP: the service sector pays a large proportion of total expenditures to factor payments like wages, capital rent and land rent. This is similar to the forestry sector, although not to the same dollar levels.

An examination of NRP indicates that the public sector contributes more proportionally to NRP than to revenue activity. This means that payments to labour, land, and capital play a large role in overall regional public sector cost structure. The public sector generates an estimated $35.6 million of NRP, representing 9.1% of the total NRP in the region. In the province, the public sector generates $22.5 billion of NRP, and the sector contributes 20.4% to provincial NRP. This is proportionally larger than the revenue contribution of the sector. The public sector provides a significant proportional contribution to NRP in the region and the province.

The visitor sector contributes an estimated $34.0 million to NRP, representing 8.4% of the total NRP generated in the region. In comparison, the province's visitor sector contributes 5.1%, or $5.6 billion, to B.C.'s NRP.

The 'rest of the economy' sector generates an estimated $81.8 million of NRP, accounting for 20.3% of the total value-added generated in the region. Similarly, the sector accounts for 16.7% of the total provincial NRP ($18.4 billion).

Royalties and Indirect Taxes

Agricultural firms in the region pay an estimated $584,835 in the form of public lease payments and indirect taxes. The agriculture sector accounts for 0.6% of the total payments made by all sectors within the Nadina Forest District. Agriculture payments on leasing public lands and indirect taxes totalled $598.7 million, representing 2.3% of total payments by all provincial sectors. In both the Nadina Forest District and the province's agriculture sectors, the proportion of payments on indirect taxes and public land rents is slightly higher than the proportional contribution to revenue and NRP. This could be explained by low returns to large land areas and a high proportion of purchase of intermediate goods used in the production process.

The forest sector pays an estimated $88.3 million dollars in stumpage and indirect taxes. This represents approximately 83.7% of payments made by all sectors in the region. The high volume of use of the public forest resource for timber extraction explains this. The provincial forest sector pays approximately $2.5 billion (9.4%) in stumpage and indirect taxes. Table 15 shows the stumpage estimates by TSA in the Nadina Forest District.

The Nadina Forest District contributed a significant amount of money in stumpage revenues—by far the highest proportion of all the districts in the region. Also, the Morice and Lakes TSAs typically have higher average stumpage rates for "all others" than the province has.

Table 15. Summary of stumpage billings for the Nadina Forest District.*

Forest district	BC timber sales**			All others***		
	Volume (m^3)	Average rate ($ / m^3)	Value billed ($)	Volume (m^3)	Average rate ($ / m^3)	Value billed ($)
Morice	174 388	21.66	3 777 244	2 054 042	21.10	43 340 286
Lakes	748 580	10.75	8 047 235	1 496 004	17.15	25 656 469

(Revenue Branch 2002)

* Figures exclude deciduous species, waste, and reject.

** B.C. Timber Sales are typically subjected to higher stumpage rates because, in contrast to licensees, the B.C. Ministry of Forests incurs development, road construction, silviculture, and administrative costs. Stumpage is the fee that individuals and firms are required to pay to the government when they harvest Crown timber.

***The "All Others" category includes all provincial Crown land except BC Timber Sales and timber licences.

The service sector pays an estimated $1.7 million in indirect taxes. This represents 1.7% of all royalties and indirect taxes paid by all sectors. Comparatively, the provincial service sector pays $18.3 billion, 70.2%, in indirect taxes.

The public sector in the region pays an estimated $6.9 million in indirect taxes. This represents 6.6% of all royalty and indirect tax payments from all sectors in the region. Provincially, the public sector pays $1.7 billion, or 6.6%, of all indirect taxes.

The visitor sector pays an estimated $2.8 million in indirect taxes. These indirect tax payments total 2.7% of payments made by all sectors in the region. Province wide, the visitor sector pays $703.1 million in indirect taxes, or 2.7% of all visitor sector payments made in the province.

In the region, the rest of the economy sector pays an estimated $5.1 million in royalties and indirect taxes. This accounts for 4.8% of all payments in the region. In the province, royalties and indirect taxes amount to $2.3 billion, or 8.8%, of total royalty and indirect tax payments from all sectors.

Labour Income

Gross labour earnings in the Nadina Forest District agriculture sector totalled an estimated $695,877. This represents approximately 0.3% of the total gross wages earned across all sectors in the region. Gross wages earned in the provincial sector totalled $625.6 million, 1.1% of total provincial labour income. The small proportional contribution of the agriculture sector to total labour income earned across all sectors is an indication of lower-than-average wages. This could be explained by hobby-farm lifestyles and the pursuit of agriculture as a source of supplemental employment and income.

The forest sector pays an estimated $113.5 million in salaries and wages. This represents 49% of all labour income earned in the Nadina Forest District area, and suggests high dependence on forestry. Comparatively, the provincial forestry sector pays $4.2 billion, or 7.3%, in salaries and wages. Although forestry is important to overall economic health of the province, the Nadina Forest District is acutely dependent on the health of this sector.

The regional service sector pays an estimated $7.6 million in salary and wages, or 3.3% of all labour income earned within the Nadina Forest District. On a provincial scale, the service sector pays $18.1 billion, or 31.5%, in salaries and wages. This suggests that a great deal of the cost structure of the service sector is dedicated to the payment of labour, as opposed to capital, land, and intermediate goods used in production.

The public sector contributes an estimated $24.2 million in salaries and wages, representing 10.4% of the total labour income paid in the district. Province-wide, the public sector pays $18.3 billion in salaries and wages, or 31.8% of labour income earned provincially. The high percent contribution of the public sector to regional income indicates the importance of the public sector as an economic stabilizer that buffers against downturns in the forest sector. The public sector also offers higher-than-average paying employment opportunities in the region.

The visitor sector pays an estimated $25.0 million in salaries and wages. This accounts for 10.8% of all labour income derived in the Nadina Forest District. In the province, the visitor sector pays $4.4 billion in salaries and wages, accounting for 7.7% of total provincial labour income.

Regionally, the rest of the economy sector pays an estimated $60.8 million in salaries and wages. This accounts for 26.2% of all labour income payments by all sectors in the district. Similarly, in the province, labour income payments from the rest of the economy sector amount to $11.9 billion, or 20.7% of all labour income derived in the province.

Employment

Approximately 190 employment positions are supported by the agriculture industry in the Nadina Forest District. Proportionally, this represents 1.9% of total employment in the region. In the province, the agriculture sector generates 85,080 primary employment positions, or 4.2% of total employment. Compared to the other indicators, agriculture contributes a higher proportion to the total number of employment positions generated. In both the region and the province, agriculture generates a large number of lower-paying employment positions.

The forest sector generates an estimated 2,495 employment positions—full and part time. This represents 24.5% of overall employment in the region. At the provincial level, the forest sector accounts for 98,280 (4.9% of) primary employment positions. The sector contributes less proportionally to employment than to revenue, NRP, royalties and indirect taxes, and labour income. This is reflected by the nature of the forest industries that require highly skilled labour with proportionally higher salaries and wages.

The service sector generates an estimated 816 employment positions in the region, or 8.0% of the total number of regional positions. The service sector generates a large number of employment positions compared to the amount of revenue and NRP generated. Although the sector's cost structure has a high proportional payment to labour, the even higher proportion of labour generated means that there are numerous lower-paying positions. This relationship does not hold true throughout the province: B.C.'s service sector is characterized by 502,240 primary employment positions, or 24.9% of total provincial employment. In contrast to the region's service sector, the provincial service sector generates a large amount of labour income for the number of primary employment positions.

The public sector generates 865 employment positions in the region. This accounts for 8.5% of existing employment positions. In the province, the public sector consists of 470,750 primary employment

positions. The percent contribution of the regional public sector is well below the overall contribution of the provincial public sector at 23.4% of total employment.

The visitor sector generates many employment positions in both the overall province and the study region. In the region, the visitor sector generates an estimated 2,262 employment positions, or 22.2% of total regional employment. In the province, the visitor sector accounts for 256,400 primary employment positions (12.7%). This high proportion suggests that visitor sector industries on average are labour intensive (requiring a high proportion of labour compared to capital and land).

The rest of the economy sector generates an estimated total of 3,549 employment positions in the Nadina Forest District. This accounts for 34.9% of all employment positions generated within the region. In comparison, the sector generates 601,860 primary employment positions, or 29 9%, of total provincial employment.

Discussion

The detailed sector analysis reveals large variance in the economic contribution among major sectors found in the region. The baseline regional economic indicator levels contained in this report can be used as a starting point to track change and progress over time. The information can also be used to analyze proposed policy changes.

Agriculture is a major sector in terms of physical impact on the regional landscape, but its contribution to the economy in terms of revenue, NRP, and labour income is minimal compared to the contributions of other sectors. Because of this, expansion of existing agricultural industries may not provide significant economic diversity or stability. The agriculture sector in the Nadina Forest District is characterized by below-average labour incomes. However, individuals often choose an agricultural lifestyle and use it to supplement their income.

Forestry is the dominant sector in the region. The forest sector contributes the largest share to regional total revenue, NRP, labour income, and the majority of royalties and indirect taxes collected. However, forestry contributes less to regional employment than it does to total revenue, NRP, etc., as a result of the capital intensity of production structure. Despite this lower contribution, the forest sector is characterized by high-paying employment positions.

Next to agriculture, the domestic services sector contributes the least to the regional economy. Unlike the forestry sector, the service sector contributes proportionally higher to employment than to monetary indicators. However, this indicates that although the services sector contributes numerous employment positions, they pay little. The potential for expansion of the service sector relates to the size of the domestic human population available to support it.

Education, health, and government services can act as regional diversification and buffer negative impacts in resource sectors. However, changes in the public sector also cause instability. The public sector in the Nadina Forest District does not provide as many employment positions as the visitor sector does, nor do these positions tend to pay as well as the forestry sector (on average). However, the public sector offers numerous employment positions with above-average wages.

The visitor sector is the second largest sector in terms of revenue generation in the region, and contributes slightly more than the provincial average. The visitor sector provides a large percentage of the total employment positions in the region; however, similar to the domestic services sector, these positions are characterized by low wages. The retail sector and the service sector are shared among residents and visitors. If the resident population does not increase, promotion leading to increased visitations could provide impetus to increase services available to all.

The rest of the economy sector consists of all remaining sectors that are less developed or that cannot be identified due to confidentiality constraints. Mining and petroleum offer development potential and, at present, the mining sector, which consists of one firm, contributes 175 direct employment positions that pay well. However, the majority of the rest of the economy is comprised of the retail sector. The retail sector contributes the highest number of employment positions; however, they are characterized by low wages and a greater proportion of part-time positions compared to positions in the public and the sectors.

Prince George Timber Supply Area

Sector Backgrounds

Agriculture

Ranching and agriculture have played an important part in the Prince George Timber Supply Area (Prince George TSA) history and economy since the turn of the century. Agricultural activity contributes to the stability of the economy within the region. Livestock production is the most common agricultural activity, along with production of forage and cereal crops. Vegetables and small fruits are also grown in the area (MSRM 1997, 1999a, 1999b). For example, in the Vanderhoof district, there has been a recent increase in greenhouse production of flowers and vegetables and in production of organic produce.

Most agricultural activity in the TSA occurs in the Vanderhoof and Prince George districts (BCMoF 2001). The arable land in these two districts is a part of B.C.'s most fertile agricultural region, the Nechako Valley. There has been tremendous development of agricultural land in these areas during the last two decades. The expansion of agricultural land lease policies in B.C. has facilitated conversion of forest land to the production of forage and cereal crops (MSRM 1997). Some land in the region had been designated part of the agricultural land reserve (ALR). The agricultural land reserve is a provincial zone in which agriculture is recognized as the priority use. It covers more than 4.7 million hectares of private and public lands throughout the province (PALC 2004). Not all of the arable land in the TSA is part of the agricultural land reserve (MSRM 1999a).

In the Prince George district, 439 farms operate on 73,000 hectares of developed agricultural land. Of these, 253 are beef cattle ranches (MSRM 1999b). The Vanderhoof district has 470 farm operations. Production of field crops uses 125,000 hectares of land, and 250,000 hectares are used for grazing more than 40,000 head of cattle (V – IFPA 2001).

There are three large commercial fisheries in the region: salmon (chinook and sockeye), steelhead, and freshwater. In the Prince George District, there are two significant salmon-production systems that feed the downstream commercial salmon industry. These are the Nechako–Stuart system, and the Upper Fraser system. Representing about 15 to 18% of total fish escapements, the Prince George fishery is B.C.'s largest salmon-producing system. The estimated volume of the commercial fish catch is 1.9 million sockeye and 32,000 chinook salmon, carrying an average commercial value of $28 million and $1.2 million per year, respectively. The steelhead fishery is located within the northwest corner of the Fort St. James district (Deloitte & Touche 1996).

Forestry

As of 2002, about 71% of the McGregor Model Forest (7,508,191 ha) was considered productive forest area managed by the Crown. About 62% of this, or 3,325,683 hectares, is considered available for timber harvesting under current forest management practices (BCMoF 2001; BCMoF 2002b). In the Prince George TSA, 29% (2,180,917 hectares) of the total area is privately owned, non-forested, or allocated to agricultural leases (Figure 4). Twenty-seven percent (2,001,590 ha)—most of which is environmentally sensitive or of low productivity—of the total area has been removed from the calculation of productive forest. This leaves 44% available for timber harvesting.

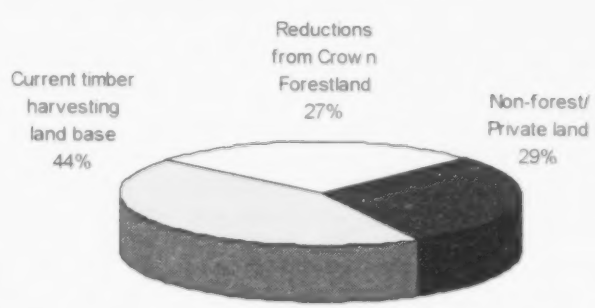

Figure 4. Timber availability on the Prince George TSA land base.

On June 1, 2002, the annual allowable cut (AAC) for the TSA increased from 9.4 million m^3/year to 12.2 million m^3/year to aid in management of the mountain pine beetle epidemic (BCMoF 2002b). For the purpose of this analysis, it is assumed that the pre-increase AAC level of 9.4 million m^3 will best represent the economic database constructed for the region. The AAC is the allowable rate of timber harvest from a specified area of land. The chief forester sets AACs for TSAs and tree farm licenses (TFLs) in accordance with Section 7 of the *Forest Act*. Within the Northern Interior Forest Region, the Prince George TSA has the largest AAC, which accounts for 42% of the region's total AAC (Table 16).

Table 16. Northern Interior Forest Region's AAC.

TSA	AAC m^3/yr	% of total
Bulkley	882 000	3%
Cassiar	305 000	1%
Cranberry	110 000	0%
Dawson Creek	1 860 000	6%
Fort Nelson	1 500 000	5%
Fort St. John	2 115 000	7%
Kalum	436 884	1%
Kispiox	977 000	3%
Lakes	2 962 000	10%
MacKenzie	3 050 000	10%
Morice	1 961 117	7%
Nass	865 000	3%
Prince George	**12 244 000**	**42%**
Total	**29 268 001**	**100%**

(BCMoF 2004a)

Annual allowable cut for the Prince George TSA increased again in late 2004. This increase allows for increased harvest of mountain pine beetle-killed trees during the next five years. The Prince George area is one of the areas hardest hit by the beetle epidemic, along with the Lakes and Quesnel TSAs (BCMoF 2004b).

There are three tree farm licenses (TFL) located within the Prince George TSA. TFLs have separate AAC that are additional to the TSA's AAC. Tree Farm License #30, operated by Canfor, has an AAC of 330,000 m^3; TFL #42, operated by Tanizul Timber Ltd., has an AAC of 160,000 m^3; and TFL #53, operated by Dunkley Lumber Ltd., has an AAC of 500,000 m^3.

The B.C. Ministry of Forests, in accordance with Section 8 of the *Forest Act* distributes each TSA's AAC among timber tenures. The distribution is termed AAC apportionment. Currently, 77.0% of the study area's available timber volume is allocated to Forest Licenses, and 21.6% is allocated to B.C. Timber Sales (Table 17). The remaining AAC is distributed among replaceable timber sale licenses, community forest agreements, and the forest service reserve.

Table 17. AAC by form of agreement.

Timber disposition	AAC (m^3)	Proportion of AAC (%)
Forest licences (replaceable & non-replaceable)	9 434 132	77.0
TSL (replaceable > & <= 10000 m^3, non-replace, pulpwood agreement)	5 859	0.0
B.C. Timber Sales	2 644 588	21.6
Timber sale licence/licence to cut	2 494 588	20.4
Forest licence non-replaceable	150 000	1.2
TSA temporary AAC increase	0	0.0
Woodlot license	0	0.0
Community forest agreement	8 290	0.1
Forest service	151 131	1.2
Total	12 244 000	100

(BCMoF 2004C)

Table 18, which displays the AAC by commitment (BCMoF 2004c), shows that CANFOR is by far the largest license holder with more than half the area's licenses (54%). A few other companies hold another 22% of the area's licenses. These are West Fraser Mills Ltd., Carrier Lumber Ltd., The Pas Lumber Company Ltd., and L & M Lumber Ltd. with 7%, 6%, 5% and 4% of total AAC, respectively.

Table 18. Distribution of Prince George TSA AAC by commitment.

Form of agreement	Current licensee	Volume (m^3)	*Percent of total* commitments
Forest licenses replaceable	L & M Lumber Ltd.	140 088	1.47%
	Apollo Forest Products Ltd.	216 746	2.28%
	Canadian Forest Products Ltd. (CANFOR)	4 829 723	50.81%
	Carrier Lumber Ltd.	253 027	2.66%
	Stella-Jones Inc.	47 048	0.49%
	West Fraser Mills Ltd.	336 821	3.54%
	Lakeland Mills Ltd.	254 102	2.67%
	Stuart Lake Lumber Co. Ltd.	201 978	2.12%
	The Pas Lumber Company Ltd.	505 541	5.32%
	Weldwood of Canada Ltd.	20 320	0.21%
	Total	*6 805 394*	*71.59%*
Forest licenses non-replaceable	Takla Track & Timber Ltd.	200 000	2.10%
	Canadian Forest Products Ltd. (CANFOR)	200 000	2.10%
	Takla Development Corporation	80 000	0.84%
	L & M Lumber Ltd.	250 000	2.63%
	Cdn. Forest Products Ltd. - Moberly First Nations	100 000	1.05%
	TRC Cedar Ltd.	80 000	0.84%
	Dunkley Lumber Ltd.	30 000	0.32%
	Castle Creek Forest Products	30 000	0.32%
	Carrier Lumber Ltd.	300 000	3.16%
	West Fraser Mills Ltd.	300 000	3.16%
	Nabesche Holdings Ltd.	150 000	1.58%
	Basghelh Holdings Ltd.	150 000	1.58%
	Yun Ka Whu'ten Holdings Ltd.	50 000	0.53%
	Chamber of Commerce	30 000	0.32%
	Yekooche First Nation	100 000	1.05%
	Saik'uz First Nation	150 000	1.58%
	Chunzoolh Forest Products Ltd.	50 000	0.53%
	Cheslatta Forest Products Ltd.	50 000	0.53%
	Stellako Custom Wood Ltd.	150 000	1.58%
	B&T Forest Products Ltd.	20 000	0.21%
	Za Mari Economic Development Corporation	15 000	0.16%
	Total	*2 485 000*	*26.14%*
TSL<=10000 m^3 replaceable	Gordon Peters Logging Ltd.	398	0.00%
	Svend Serup	570	0.01%
	Esther Perry	2 070	0.02%
	Huber Poole	246	0.00%
	474483 British Columbia Ltd.	171	0.00%
	Number 248 Holdings Ltd.	1 748	0.02%
	519709 BC Ltd./Steven Schwartz/Robin Tutte	598	0.01%
	Total	*5 801*	0.06%
BCTS forest licenses non-replaceable	FSJ All Nations Forest	60 000	0.63%
	Dzitl-Ainli Forest Corporation	50 000	0.53%
	Ta-Da-Chun Timber Ltd.	100 000	1.05%
	Total	*210 000*	*2.21%*
Total commitments		9 506 195	100%

In 2000, there were 27 mills operating in the Prince George TSA. This included 19 lumber mills, three pulp mills, one paper mill, two chip mills, one pole producer, and one veneer plywood mill. Between 1998 and 2000, the solid wood mills processed about 10.1 million m^3 of timber annually (BCMoF 2002b).

Most of the mills are located in the Prince George forest district. A substantial amount of wood harvested in surrounding districts is brought there for processing. For example, more than half the wood harvested in the Fort St. James district is processed outside the district. From a community economic development perspective, this is a substantial loss of jobs and income for smaller communities (MSRM 1999a).

Domestic Services

The domestic service sector relates only to expenditures on non-industry specific services by residents and local businesses. In June 2002, there were 2,838 service-related businesses in the four Statistics Canada census subdivisions found in the TSA (Table 19). Prince George has the largest number of service-related businesses. The most common type of service is construction, except in Fraser Lake where the most common kinds of services are transportation and warehousing.

Table 19. Summary of domestic service businesses for census subdivisions in the Prince George TSA.

	Prince George		Fort St. James		Vanderhoof		Fraser Lake	
Service type	#	%	#	%	#	%	#	%
Construction	707	30	41	28	88	31	9	20
Transportation & warehousing	478	20	49	34	75	27	14	30
Information & cultural industries	38	2	1	1	8	3	1	2
Finance & insurance	180	8	4	3	9	3	1	2
Professional, scientific & technical services	465	20	18	12	49	17	5	11
Arts, entertainment & recreation	55	2	6	4	8	3	3	7
Other services (excluding public administration)	443	19	26	18	44	16	13	28
Total	2 366	100	145	100	281	100	46	100

(Statistics Canada 2002)

Public

Table 20 shows the breakdown of public sector employment by industry. The social industry, which consists of the educational service industry (including colleges) and health and social service industries (including dentists with private practices), supports the largest number of employment positions and contributes the largest share of income in the government sector.

Table 20. Employment statistics for the public sector.

Community or area	Employees 2001		
	General	Social	Utilities
Prince George	2 320	6 965	265
Vanderhoof	90	460	10
Fort St. James	80	175	0
Fraser Lake	45	115	0
Prince George TSA total	3 320	9 195	330

(Statistics Canada 2001)

Visitor

According to the Wellstead et al. (2000) methodology of using the term "visitors," which includes not only "tourists" but also those traveling for business and personal reasons, nearly 2.2 million travelers visited the northwest region, as defined by the *B.C. Visitor Study: Report on Travel In British Columbia – Northwest Region* (Tourism B.C. 1998), and spent $425 million. This represents 7% of all visitors to the province, and 5% of tourism revenue generated throughout the province. About 62% of travelers to the region, or 980,880 B.C. residents and 397,310 non-residents, visited the Fraser Fort George area, which includes Prince George and Vanderhoof. This was the most popular region visited in the northwest. It is estimated that travelers spent approximately $267.6 million there. Average expenditures per person per day, including both B.C. residents and non-residents, were $54. The average expenditure per trip was $178 by B.C. residents, who stayed an average of 3.4 days, and $234 by non-residents, who stayed an average of 4.4 days (Tourism B.C. 1998).

Tourism B.C. (2004) reports a variety of tourism indicators on a monthly and yearly basis. In 2003, the room revenue in the northern tourism region was $97 million, a 9% increase over that of 2002. For the city of Prince George, accommodation room occupancy rate was 62%, a 5% increase. There were 339,819 passengers who used the Prince George regional airport in 2003, a 4% increase over the year before.

Key tourism and recreation activities within the Prince George TSA include cross-country and downhill skiing, hiking, whitewater rafting, boating, canoeing, kayaking, caving, trail riding, fishing, hunting, trapping, and ecotourism (Deloitte & Touche 1996). The visitor study for the northwest region (Tourism B.C. 1998) confirms that outdoor wilderness activities are a major reason why people visit northwest B.C., with fishing, boating, and hunting being common activities.

The Vanderhoof forest district is a stopping place for travelers headed to Prince Rupert or Alaska, but more people stay in the district to take advantage of the outdoor recreation opportunities (MSRM 1997). Approximately 2,500 kilometres of forest road in the district provide public access to many popular summer and winter recreation activities. There are 39 forest service recreation sites and 20 major hiking trails that generated more than 34,500 and 12,000 user days of recreational activity in 1994, respectively. Numerous heritage and archaeological sites within the district also attract visitors (V-IFPA 2001).

In the Fort St. James forest district the most common recreation activities are camping, boating, fishing, and hunting. For public use, there are 60 maintained recreation sites and six maintained recreational trails, as well as provincial parks. Twelve licensed guide–outfitters operate in the district, with an average annual client base of 15 to 35. It is estimated that visitors to the area will increase by approximately 15% annually. In 1993, the Fort St. James information centre had 2,331 visitors (MSRM 1999a).

The Prince George forest district has significant outdoor recreation opportunities, with provincial parks, recreation sites and heritage sites. These are gaining in popularity and attracting visitors. Another big draw for visitors to the area is the city of Prince George. With Highways 16 and 97 intersecting within city limits, British Columbia Railway and Canadian National Railway running through, and the presence of a national airport, the city is the transportation hub for northern B.C. It has also established itself as the regional centre for retail, health care, sports, entertainment, and the arts (MSRM 1999b).

Rest of the Economy (ROE)

The rest of the economy mainly consists of the retail and mining sectors. Within the four census subdivisions in the TSA, there are 261 wholesale businesses and 573 retail businesses (Table 21). This accounts for 13% of all businesses in these areas (Statistics Canada 2002).

Table 21. Summary of retail service businesses for census subdivisions (CSD) in the Prince George TSA.

	Prince George	Fort St. James	Vanderhoof	Fraser Lake
Wholesale	229	8	23	1
Retail	472	38	49	14
Total	701	46	72	15

(Statistics Canada 2002)

There is a long history of mining and mineral extraction in the TSA, but at the present time only one mine is active—the Endako Molybdenum mine, located near the village of Fraser Lake. The Endako mine is co-owned by Thompson Creek Mining Ltd., and Nissho Iwai Mcly Resources Inc. It is an open-pit operation with on-site milling (Endako Mines 2004). As of 1995, the mine had 117.6 million tonnes in reserves, enough for a continued mine life of 14 years (MRSM 1997). In 2002, 9.5 million tones of ore were mined and milled on site. This produced 5.5 million kilograms of molybdenum for sale (BCMEM 2004a).

Two other mines in the area were active in the last 10 years. The Dahl Lake Limestone mine produced 20,000 tones of decorative aggregate per year (last reported in 1997). The Giscome Limestone mine last reported production of 50,000 tones of limestone in 1997. These mines were all in the vicinity of Prince George (BCMEM 2004a). Although these mines have not produced recently, other operating mines outside the Prince George TSA rely on Prince George as their supply centre. In this way, mining continues to indirectly impact the city's economy (MSRM 1999b). The largest of these mines is the Kemess South Mine, which produces gold and copper, and is located 430 km north of the city. In 2002, the mine contributed $24 million to the Prince George economy, and many of its 440 employees live in the city (Initiatives Prince George 2004).

Mineral exploration contributes to economic activity in each of the three forest districts that comprise the TSA. The extent of exploration increases the potential for new mine development in the area. In the Fort St. James district, mineral exploration and small-scale mining account for 3% of basic employment in the district. As of 1999, there were 277 documented mineral occurrences in the Fort St. James district (MSRM 1999a). In the area surrounding Prince George, investment in mineral exploration was estimated at $11 million in 2002 (Initiatives Prince George 2004)

The Prince George TSA includes portions of three major oil reserves: the Bowser Basin, the Nechako Basin and the Quesnel Trough. Exploration for the oil and gas industry continues in the northwest of B.C. This may provide an area for regional economic development (BCMEM 2004b).

Indicator Summary

The economic impacts of each sector within the Prince George TSA are summarized, according to the economic indicators selected for the study, in Table 22.

Table 22. Baseline economic data for the Prince George Timber Supply Area.

Sector	Prince George TSA		BC	
	Gross revenue ($M)	% of total	Gross revenue ($)	% of total
Agriculture	49.4	0.5	5.5	1.9
Forestry	2 359.1	22.1	17.6	6.1
Service	3 327.6	31.2	141.1	49.1
Public	672.1	6.3	37.7	13.1
Visitor	805.8	7.6	13.6	4.7
Rest of the economy	3 437.9	32.3	71.9	25.0
Total	**10 651.9**	**100.0**	**287.5**	**100.0**
	Net regional product ($M)	% of total	Net regional product ($)	% of total
Agriculture	30.2	1.0	1.8	1.6
Forestry	1 149.9	36.4	8.0	7.2
Service	597.6	18.9	54.1	49.0
Public	506.3	16.0	22.5	20.4
Visitor	178.1	5.6	5.6	5.1
Rest of the economy	698.8	22.1	18.4	16.7
Total	**3 160.8**	**100.0**	**110.5**	**100.0**
	Royalties and indirect taxes ($M)	% of total	Royalties and indirect taxes ($)	% of total
Agriculture	5.3	0.7	0.6	2.3
Forestry	394.9	53.8	2.5	9.4
Service	206.1	28.1	18.4	70.2
Public	22.8	3.1	1.7	6.6
Visitor	41.7	5.7	0.7	2.7
Rest of the economy	62.9	8.6	2.3	8.8
Total	**733.8**	**100.0**	**26.2**	**100.0**
	Gross wages ($M)	% of total	Gross wages ($)	% of total
Agriculture	19.5	1.2	0.6	1.1
Forestry	346.2	21.6	4.2	7.3
Service	294.5	18.3	18.1	31.5
Public	450.7	28.1	18.3	31.8
Visitor	108.6	6.8	4.4	7.7
Rest of the economy	385.8	24.0	11.9	20.7
Total	**1 605.3**	**100.0**	**57.6**	**100.0**
	# of employment positions	% of total	# of employment positions	% of total
Agriculture	1 435	2.6	85 080	4.2
Forestry	6 675	12.0	98 280	4.9
Service	11 145	20.0	502 240	24.9
Public	12 845	23.0	470 750	23.4
Visitor	4 925	8.8	256 400	12.7
Rest of the economy	18 715	33.6	601 860	29.9
Total	**55 740**	**100.0**	**2 014 610**	**100.0**

Revenue

Agriculture and related services account for an estimated $49.4 million of gross revenue in the Prince George TSA. This represents approximately 0.5% of the total amount of economic activity generated in the region. The agriculture sector is comparatively more predominant in the province, contributing approximately $5.5 billion, or 1.9% of total gross revenue activity. Although agriculture is the smallest sector in terms of revenue, it is associated with a rural lifestyle and represents a potential area for economic diversification and development.

Forestry and related services represent the single largest natural resource sector in the TSA. Forestry generates an estimated $2.4 billion in gross revenue activity, or 22.1% of total revenue in the region. In B.C., forestry generates $17.6 billion in revenue. However, at 6.1%, forestry contributes proportionally less to total provincial revenue compared to its contribution in the region (22.1%). This indicates that the region is more dependent on forestry than the province is and, as a result, negative activity in the forest sector is more acute in the region than throughout the province.

The service sector contributes an estimated $3.3 billion of gross revenue to the regional economy, or 31.2% of the total revenue generated from all sectors. Prince George is the service centre for most northern communities and, as such, has a well-developed service sector. In the B.C. economy, the service sector is the largest sector, followed by the aggregate 'rest of the economy' sector. The regional service sector is less developed than that of the province, and compares in size to the aggregate rest of the economy. The service sector accounts for $141.1 billion, or 49.1% of revenue generation for B.C.

The public sector produces an estimated $672.1 million in revenue for the region. This accounts for 6.3% of revenue generation activities in the regional economy. Provincial public sector totals equal $37.7 billion, representing 13.1% of all sector activity.

The visitor sector accounts for $805.8 million of gross revenue in the region, or 7.6% of the total gross revenue generated. This is comparable to the percent contribution of the visitor sector in the overall province at 4.7%, or $13.6 billion.

The rest of the economy accounts for an estimated $3.4 billion of gross revenue, or 32.3% of the total revenue derived from regional economic activity. Provincially, the rest of the economy accounts for $71.9 billion, or 25.0% of gross revenue.

Net Regional Product (NRP)

The agriculture sector generates an estimated $30.2 million of net regional product (value-added; NRP), or 1.0% of the entire net regional product generated from the regional economy. The provincial agriculture sector generates $1.8 billion (1.6%) for the entire province. Similar to gross revenue, the agriculture sector currently makes the smallest contribution to NRP. This relationship also holds true in the overall provincial economy.

Forestry accounts for an estimated $1.1 billion of NRP. This represents 36.4% of the total value-added generated in the region. Comparatively, forestry generates $8.0 billion, or 7.2% of net regional product in B.C. The forestry sector has a large proportional contribution to NRP compared to other sectors. This relationship is strong in the region, suggesting high factor payments to labour, land, and capital. This is also a reflection of the high forest productivity in the region.

The service sector generates an estimated $597.6 million in NRP. This accounts for 18.9% of all NRP generated in the Prince George TSA. In the province, the service sector accounts for $54.1 billion, or 49.0% of provincial NRP. Proportionally, the service sector contributes less than average to NRP. In other words, the service sector pays a smaller proportion of total expenditures to factor payments like wages, capital rent and land rent. This is in contrast to the forestry sector which has a high proportion of total expenditures dedicated to wages, capital, and land.

An examination of NRP indicates that the public sector contributes proportionally more to NRP than to revenue activity. This means that payments to labour, land, and capital play a large role in the overall regional public sector cost structure. The public sector generates an estimated $506.3 million of NRP, representing 16.0% of the total NRP in the TSA. In the province, the public sector generates $22.5 billion of NRP. The public sector has a more significant proportional contribution to NRP in the region than in the province.

Although proportional revenue contributions are similar between region and province, the provincial visitor sector makes a slightly smaller contribution to NRP than the regional sector does. The visitor sector

contributes an estimated $178.1 million to NRP, or 5.6% of total NRP generated in the region. In comparison, the provincial sector contributes 5.1% to overall NRP.

The rest of the economy sector generates an estimated $698.8 million of NRP, accounting for 22.1% of total value-added generated in the region. Similarly, the rest of the economy in the province accounts for 16.7% of total NRP, with $18.4 billion.

Royalties and Indirect Taxes

Agricultural firms pay an estimated total of $5.3 million in the form of public lease payments and indirect taxes. The agriculture sector accounts for 0.7% of the total payments made by all sectors within the Prince George TSA. Province-wide, agricultural payments on leased public lands and indirect taxes totalled $598.7 million, representing 2.3% of total payments by all provincial sectors.

The forest sector pays an estimated $394.9 million dollars in stumpage and indirect taxes, or about 53.8% of payments made by all sectors in the region. The high volume of use of the public forest resource for timber extraction, or 9.4% of all royalties and taxes paid in B.C.

Table 23 shows the stumpage estimates by forest district for the TSA. The Prince George, Vanderhoof, and Fort St. James Forest Districts contributed a significant amount of money in stumpage revenues (Revenue Branch 2002).

Table 23. Summary of stumpage billings for the Prince George TSA.*

	BC Timber Sales**			All Others***		
Forest District	Volume (m^3)	Average rate ($ / m^3)	Value billed ($)	Volume (m^3)	Average rate ($ / m^3)	Value billed ($)
Prince George	920 066	23.17	21 317 929	4 287 547	25.82	110 704 464
Vanderhoof	1 257 785	15.54	19 545 979	2 490 650	20.77	51 730 800
Fort St. James	549 441	26.45	14 532 714	2 613 293	22.59	59 034 289

* Figures exclude deciduous species, waste, and reject.

** B.C. Timber Sales are typically subjected to higher stumpage rates because, in contrast to licensees, the B.C. Ministry of Forests incurs development, road construction, silviculture, and administrative costs. Stumpage is the fee that individuals and firms are required to pay to the government when they harvest Crown timber.

***The "All Others" category includes all provincial Crown land except BC Timber Sales and timber licences.

The service sector pays an estimated $206.1 million in indirect taxes, or 28.1% of all royalties and indirect taxes paid by all sectors. Comparatively, B.C.'s service sector pays $18.4 billion (70.2%) in indirect taxes.

The public sector in the region pays an estimated $22.8 million in indirect taxes, or 3.1% of all royalty and indirect tax payments from all sectors in the region. Provincially, the public sector pays $1.7 billion, or 6.6% of all indirect taxes.

The visitor sector pays an estimated $41.7 million in indirect taxes. These indirect tax payments total 5.7% of payments made by all sectors in the region. Throughout the province, the visitor sector pays $703.1 million in indirect taxes, or 2.7% of all sector payments.

In the region, the rest of the economy sector pays an estimated $62.9 million in royalties and indirect taxes, or 8.6% of all payments. In the province, royalties and indirect taxes amount to $2.3 billion, or 8.8% of total royalty and indirect tax payments from all sectors.

Labour Income

Gross labour earnings in the Prince George TSA agriculture sector totalled an estimated $19.5 million, or 1.2% of the total gross wages earned across all sectors in the region. Gross wages earned in B.C.'s agriculture sector totalled $625.6 million, or 1.1% of provincial labour income. The small proportional contribution of the agriculture sector to total labour income earned across all sectors indicates lower-than-average wages. This could be explained by hobby-farm lifestyles and pursuit of agriculture to supplement employment and income.

The forest sector pays an estimated $346.2 million in salaries and wages. This represents 21.6% of all labour income earned in the TSA, and suggests moderate dependence on the sector. Comparatively, the

B.C. forestry sector pays $4.2 billion (7.3%) in salaries and wages. Although forestry is important to overall economic health of the province, the region is more acutely dependent on the sector's health.

The regional service sector pays an estimated $294.5 million in salary and wages, or 18.3% of all labour income earned within the region. On a provincial scale, the service sector pays $18.1 billion, or 31.5%, in salaries and wages. This suggests that much of the cost structure of the service sector is dedicated to the payment of labour, as opposed to capital, land, and intermediate goods used in production.

The public sector contributes an estimated $450.7 million in salaries and wages, or 28.1% of labour income paid in the region. Province-wide, the public sector pays $18.3 billion in salaries and wages, or 31.8% of labour income. The high percent contribution of the public sector to regional income indicates the importance of the sector as a force of economic stabilization that buffers downturns in the forest sector. The public sector also offers higher-than-average paying employment opportunities.

The visitor sector pays an estimated $108.6 million in salaries and wages, or 6.8% of labour income derived in the Prince George TSA. Throughout the province, the visitor sector pays $4.4 billion in salaries and wages, accounting for 7.7% of total labour income.

Regionally, the rest of the economy sector pays an estimated $385.8 million in salaries and wages, or 24.0% of all labour income payments by all sectors. Similarly, in the province, labour income payments from this sector amount to $11.9 billion, or 20.7% of all labour income.

Employment

Approximately 1,435 primary employment positions are supported by the agriculture industry in the Prince George TSA. Proportionally, this represents 2.6% of total regional employment. In the province, the agriculture sector generates 85,080 primary employment positions, or 4.2% of total employment. Compared to other indicators, agriculture contributes a higher proportion to the total number of employment positions generated. In both the region and the province, agriculture generates a large number of lower-paying positions.

The forest sector generates an estimated 6,675 primary employment positions, or 12.0% of overall employment in the region. In B.C., the forest sector generates 98,280, or 4.9% of, all primary employment positions. The sector contributes proportionally less to employment than to revenue, NRP, royalties and indirect taxes, and labour income: forest industries are high-capital intensive, require highly skilled labour, and pay proportionally higher salaries and wages.

The service sector generates an estimated 11,145 primary employment positions in the TSA, or 20.0% of the total number of regional employment positions. The sector generates a proportionally greater number of employment positions than revenue and NRP. Although the cost structure of the sector has a high proportion of payment to labour, the even higher proportion of labour generated means there are numerous lower-paying positions. This relationship does not hold true throughout B.C.: the provincial service sector is characterized by 502,240 primary employment positions, accounting for 24.9% of total provincial employment. Compared to the region, the provincial service sector generates a large amount of labour income for the number of primary employment positions.

The public sector generates 12,845 primary employment positions in the region, or 23.0% of employment positions. In the province, the public sector consists of 470,750 primary employment positions, or 23.4% of primary employment positions.

In the region, the visitor sector generates an estimated 4,925 employment positions, or 8.8% of total regional employment. In the province, the visitor sector accounts for 256,400 (12.7%) primary employment positions. This high proportion suggests that visitor sector industries are labour intensive, requiring a high proportion of labour compared to capital and land.

The rest of the economy sector generates an estimated 18,715 employment positions, accounting for 33.6% of all positions generated within the region. In comparison, the sector for the province generates 601,860 primary employment positions, or 29.9% of total provincial employment.

Discussion

The detailed sector analysis reveals large variance in the economic contribution among the major sectors found in the region. The baseline regional economic indicator levels contained in this report can be used as a starting point to track change and progress over time. The information can also be used to analyze proposed policy changes.

Agriculture is an important sector in terms of physical impact on regional landscape, but its contribution to the economy in terms of revenue, NRP, and labour income is minimal compared to contributions by other sectors. Because of this, expansion of existing agricultural industries may not provide significant improvement in economic diversity or stability. Value-added processing of raw agricultural products or niche-market production could improve economic diversity. The agriculture sector in the Prince George TSA is characterized by below-average labour incomes; however, individuals often choose agricultural lifestyles and use it as a way to supplement income.

Forestry is the region's dominant natural resource sector. The forest sector contributes significantly to regional total revenue, NRP, labour income, and royalties and indirect taxes collected. However, forestry contributes less to regional employment than it does to total revenue, NRP, etc., because of capitally intense production. Despite the lower contribution to employment, the forestry sector is characterized by high-paying employment positions.

The domestic service sector is one of the largest sectors in the regional economy, due primarily to the economic activity in Prince George. Unlike the forestry sector, the service sector contributes a proportionally low amount to NRP, and a high amount to employment numbers—indicating numerous, lower-paying employment positions. The potential for expansion of the service sector relates to the size of the domestic human population available to support it, and the ability of Prince George to remain the service centre for northern British Columbia.

Education, health, and government services provide regional economic diversification and buffer negative changes in resource sectors. However, changes in the public sector can also cause instability. The public sector in the TSA compares with the provincial average, and is a major source of regional employment and economic activity. On average, public sector jobs are less lucrative than forestry jobs, but are above average in terms of a source of employment income.

The visitor sector is comparable to the overall provincial average amount of activity. The sector provides a large percentage of regional employment positions; however, similar to the domestic service sector, these positions are characterized by lower-than-average wages. The region is well positioned to benefit from increased visitors to the north: access to major transportation routes and natural amenities bolster tourism and provide an important source of economic diversification.

The rest of the economy sector is comprised of all remaining sectors that are less developed or that cannot be identified alone due to confidentiality constraints. Mining and petroleum offer significant development potential; however, most of the sector consists of a moderate- to well-developed retail sector. The retail industry contributes the highest number of employment positions; they are characterized by low wages and a greater proportion of part-time positions compared to those of the public and forest sectors.

Economic Impact Analysis

General Equilibrium Modeling

Overview of General Equilibrium Approaches

General equilibrium (GE) economic impact models are standard tools for assessing economic impacts of proposed industrial projects, major events, issues concerning international trade, and domestic government policy changes (Miller and Blair 1985; Pyatt and Round 1985). Every sector of an economy is linked to other sectors, whether directly through transactions (purchases and sales) or indirectly through competition for labour, capital, and land for use in production. General equilibrium models account for sector links, and provide a more complete picture of the impact that one sector can have on other sectors and on the overall economy of a region.

In addition to general acceptance by economists, general equilibrium methods also have legal precedence through their use in socio-economic components of environmental impact assessments. The models are generally deterministic in nature, and are not statistical or econometric forecasts.

Two primary approaches are used to estimate economy-wide or general equilibrium socio-economic impacts of changes in an economy: fixed price (input–output [I–O] models and social accounting matrices [SAM]), and flexible price (computable general equilibrium [CGE] models). Each approach is valid under certain circumstances. The less flexible I–O/SAM approach is an important building block for the more flexible CGE approach. Table 24 compares the general features of the two model approaches.

Fixed-price models such as I–O and SAM models are the most common general equilibrium tools, but are also limited in their scope of analysis, and rigidity and realism of assumptions. For example, basic input–output models do not account for competition among sectors for land, labour, and capital. Factor inputs are assumed to be available without limit. However, fixed-price approaches remain popular due to the availability of data at national and provincial levels, and low cost of use.

Flexible price models such as CGE models are less common, but allow limitless relaxation of the assumptions in fixed-price models. Two streams of research have developed that specifically compare fixed and flexible approaches (Seung et al. 1997; Partridge and Rickman 1998; Schreiner et al. 1999; Patriquin 2000: unpublished thesis), and examine the use of general equilibrium models to assess policy changes, global market fluctuations, and natural disturbances on regional economies or natural resource- and forest-dependent economies (Alavalapati et al. 1996; Marcouiller et al. 1996; Alavalapati and Adamowicz 1999; Alavalapati et al. 1999; Patriquin et al. 2002; Patriquin et al. 2003).

The findings of the studies referred to indicate that, although room for improvement exists, general equilibrium techniques provide valuable insight into potential impacts of changes in natural resource management. Methods from both approaches are used in this study. Borrowed from the fixed-price framework, a social accounting matrix—a hybrid regional economic database—constructed from a variety of data sources provides baseline indicator levels and the base on which more flexible tools are constructed. Region-specific CGE models are used to simulate potential impacts and future indicator levels of a variety of scenarios related to forest management. CGE models are solidly grounded in economic theory, but remain flexible enough for practical application. Although CGE models are uncommon on a regional scale, they provide unique insights not available when using more widely applied fixed-price techniques.

Table 24. Overview of general model features.

	I–O/SAM	CGE
Occurrence	Common	Rare
Complexity	Simple	More complex
Data requirements	Low	Medium
Role of prices	Fixed	Endogenous
Technology	Fixed	Not necessarily fixed
Supply of inputs	Excess capacity	Constraints possible
Time frame	Extreme shortrun	Variable
Sector impacts	Unidirectional	Multidirectional
Theoretical structure	Linear	Non-linear

General structure of the regional models

The models specified in the following section are deterministic in nature and based on the small, open economies of the Nadina Forest District and Prince George TSA. The CGE for each region contains six sectors and three primary factors of production—land, labour, and capital. The six sectors are those profiled in this study: agriculture, forestry, service, public, visitor (tourism), and a composite sector called 'rest of the economy' (in this study, mostly retail and mining). See Appendix A for detailed descriptions of the model specification.

Assumptions are made with respect to the treatment of these variables in the model. The labour supply is assumed fixed (i.e., the migration of labour between the region and the rest of the world is not considered). The labour market is modeled under the Keynesian assumption of a rigid wage rate. Under this assumption, adjustments in the labour market occur from changes in employment levels. It is

assumed that over the long run, unemployed individuals will migrate out of the region to find employment. The other two primary inputs, capital and land, are assumed to be sector specific.

Scenario Analysis

The purpose of scenario analysis is to examine the sensitivity of the economy to various changes in land-using sectors.

Nadina Forest District

Scenario Descriptions

Five scenarios examined positive and negative impacts on annual allowable cut (AAC) in the Lakes Timber Supply Area (TSA), an increase in visitor sector activity in the Nadina Forest District, and an increase in agricultural exports from the region.

The baseline AAC level in the Lakes TSA used for this analysis is 1,500,000 m^3 (BCMoF 2004d). This level was set in 1996, and was maintained until 2001. In response to the mountain pine beetle infestation, the AAC was raised to 2,962,000 m^3 in July, 2001, and was further increased to 3,162,000 in October, 2004 (BCMoF 2004d). The most recent timber supply review for the region conducted by the B.C. Ministry of Forests included a longer-term assessment of future AAC levels in light of mountain pine beetle impact on the forest. The current projection of the sustainable AAC level in the TSA is anticipated to be 1,341,000 m^3 (BCMoF 2004d). The reduction is expected in approximately 15 years. At the time the report was prepared, no changes were associated with the AAC in the Morice TSA. Table 25 provides a brief description of scenarios simulated for the Nadina Forest District.

Table 25. Description of Nadina Forest District scenarios.

Scenario	Description
1	97.5% AAC increase in the Lakes TSA (equivalent to 42.2% of total Nadina Forest District AAC).
2	110.8% AAC increase in the Lakes TSA (equivalent to 48.0% of total forest district's AAC).
3	10.6% AAC reduction in the Lakes TSA (equivalent to 4.6% of total district AAC).
4	Scenario 3 plus 8.0% increase in visitors to the district.
5	Scenario 3 plus a 134% increase in agricultural exports from the district.

Results

Table 26 summarizes the simulated changes in the economic indicators for the respective scenarios. The scenario results are expressed in terms of the average annual indicator level after the shock and percent change from the baseline indicator level.

Table 26. Nadina Forest District scenario results comparison chart.

	Baseline	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
			%		%		%	%	%		%
Total revenue ($M)	1 069.3	1 323.4	23.76	1 358.1	1 059.2	1 051.4	-1.67	-0.94	27.01	1 041.6	-2.58
Total net regional Product ($M)	403.6	554.2	37.30	574.8	393.0	391.2	-3.08	-2.64	42.40	387.3	-4.06
Total royalties and indirect taxes ($M)	105.5	155.4	47.26	162.2	101.0	101.2	-4.07	-4.29	53.73	100.1	-5.14
Total labour income ($M)	231.7	308.2	32.99	318.7	227.3	225.6	-2.65	-1.93	37.50	223.4	-3.59
Total employment	5 345	6 555	22.63	6 720	5 353	5 348	0.05	0.15	25.73	5 213	-2.46

Scenario 1

Scenario 1 simulates what the economy of the Nadina Forest District would be like with a 97.5% increase in Lakes TSA AAC over the baseline in response to mountain pine beetle damage (or an equivalent 42.2% increase in the overall AAC of the forest district). The new AAC levels would be 2,962,000 m^3, up from 1,500,000 m^3, in the Lakes TSA, and 4,923,117 m^3, up from 3,461,117 m in the overall forest district.

The results indicate a short-term economy-wide increase across all sectors in revenue, NRP, royalties and indirect taxes, labour income, and employment (Table 27). As the AAC of the region increases, the positive impact ripples throughout the other sectors. Domestic services and the rest of the economy—primarily retail and mining—are the sectors with greatest links to forestry and, therefore, benefit most from an increase in AAC. Impacts on forestry appear to have minimal effect on the agriculture and visitor sectors. Based on the current structure of the economy, the upward change in AAC has minimal impact on the visitor sector. However, if the increase in harvest levels dramatically affects the forest in the long term, preferences of future visitors may change the structure of the economy resulting in a new relationship between the visitor sector and the forest sector.

A 97.5% increase of the AAC in the Lakes TSA yields a simulated $183.3-million increase in forest sector revenue and an increase in economy-wide revenue of $254.1 million. The increase in forestry activity also results in an increase of $130.4 million in NRP from the sector, and an overall increase of $150.5 million of NRP throughout the Nadina Forest District economy. Forestry accounts for $48.0 million of the $49.9-million change in royalties and indirect taxes; it also accounts for $61.7 million of the $76.5-million increase in total labour income, and for 712 of the 1,210 total primary employment positions generated from the increase in AAC.

Table 27. Scenario 1.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	5.4	6.0	0.5	10.0
Forestry	508.8	692.2	183.3	36.0
Services	13.4	15.9	2.5	18.5
Public	61.4	65.4	4.0	6.5
Visitor	133.9	137.8	3.8	2.9
ROE	346.2	406.2	59.9	17.3
Total	1 069.3	1 323.4	254.1	23.8
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1.5	1.7	0.2	13.8
Forestry	240.0	370.4	130.4	54.3
Services	9.6	11.6	2.0	20.5
Public	36.6	39.1	2.5	6.8
Visitor	34.0	35.0	1.0	3.0
ROE	81.8	96.3	14.5	17.7
Total	403.6	554.2	150.5	37.3
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.6	0.7	0.1	13.8
Forestry	88.3	136.3	48.0	54.3
Services	1.7	2.1	0.4	20.5
Public	6.9	7.4	0.5	6.8
Visitor	2.8	2.9	0.1	3.0
ROE	5.1	6.0	0.9	17.7
Total	105.5	155.4	49.9	47.3
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.7	0.8	0.1	13.8
Forestry	113.5	175.2	61.7	54.3
Services	7.6	9.1	1.5	20.5
Public	24.2	25.8	1.6	6.8
Visitor	25.0	25.8	0.8	3.0
ROE	60.8	71.5	10.8	17.7
Total	231.7	308.2	76.5	33.0
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	100	114	14	13.8
Forestry	1 310	2 022	712	54.3
Services	429	517	88	20.5
Public	454	485	31	6.8
Visitor	1 188	1 224	36	3.0
ROE	1 864	2 194	330	17.7
Total	5 345	6 555	1 210	22.6

Scenario 2

Scenario 2 simulates a 110.8% increase in the AAC of the Lakes TSA (equivalent to a 48.0% increase in the total AAC of the Nadina Forest District), or new AAC levels of 3,162,000 m^3, up from 1,500,000 m^3, in the Lakes TSA, and 6,623,117 m^3, up from 3,461,117 m^3 in the region.

The results indicate an increase in the level of each indicator across all sectors, including a small positive impact on the visitor sector (Table 28). Total regional revenue increases by $288.9 million, due primarily to direct positive impact on the forestry sector, worth $208.4 million. NRP gains $148.2 million from the forest sector, comprising the majority of the $171.1-million regional NRP increase. Increased AAC in the Lakes TSA results in a $54.5-million gain in royalties and indirect taxes in the forestry sector, with an

economy-wide increase of $56.7 million. Labour income increases by $86.9 million, with an impact on forestry labour income of $70.1 million. The increased Lakes TSA AAC results in a gain of 809 forestry jobs, and a gain of 1,375 employment positions in the region.

Table 28. Scenario 2.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	5.4	6.0	0.6	11.4
Forestry	508.8	717.2	208.4	41.0
Services	13.4	16.2	2.8	21.1
Public	61.4	65.9	4.5	7.4
Visitor	133.9	138.3	4.3	3.2
ROE	346.2	414.4	68.1	19.7
Total	1,069.3	1,358.1	288.9	27.0
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1.5	1.8	0.2	15.7
Forestry	240.0	388.2	148.2	61.7
Services	9.6	11.9	2.2	23.3
Public	36.6	39.4	2.8	7.7
Visitor	34.0	35.2	1.2	3.4
ROE	81.8	98.3	16.5	20.1
Total	403.6	574.8	171.1	42.4
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.6	0.7	0.1	15.7
Forestry	88.3	142.8	54.5	61.7
Services	1.7	2.2	0.4	23.3
Public	6.9	7.5	0.5	7.7
Visitor	2.8	2.9	0.1	3.4
ROE	5.1	6.1	1.0	20.1
Total	105.5	162.2	56.7	53.7
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.7	0.8	0.1	15.7
Forestry	113.5	183.6	70.1	61.7
Services	7.6	9.3	1.8	23.3
Public	24.2	26.0	1.9	7.7
Visitor	25.0	25.9	0.9	3.4
ROE	60.8	73.0	12.2	20.1
Total	231.7	318.7	86.9	37.5
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	100	116	16	15.7
Forestry	1,310	2,119	809	61.7
Services	429	529	100	23.3
Public	454	489	35	7.7
Visitor	1,188	1,229	41	3.4
ROE	1,864	2,239	375	20.1
Total	5,345	6,720	1,375	25.7

Scenario 3

Scenario 3 simulates a 10.6% reduction in the AAC of the Lakes TSA, in anticipation of an eventual decrease in available timber due to salvage of mountain pine beetle-killed wood, which is equivalent to a 4.6% reduction in the total AAC of the Nadina Forest District: new AAC levels are 1,341,000 m^3, down from 1,500,000 m^3, in the Lakes TSA, and 3,302,117 m^3, down from 3,461,117 m^3, in the region.

The results of Scenario 3 yield reductions in levels of each indicator across all sectors (Table 29). Total regional revenue decreases by $27.6 million, due primarily to direct negative impact ($19.9 million) on the forest sector. NRP from the forestry sector drops $14.2 million, comprising most of the $16.4-million reduction in the total regional NRP. The 10.6% reduction of the AAC in the Lakes TSA results in a $5.2-million drop in royalties and indirect taxes from the forestry sector, with an overall economy-wide drop of $5.4 million. Labour income from the forestry sector decreases by $6.7 million, contributing to an overall loss in labour income of $8.3 million. A 10.6% reduction results in a simulated loss of 77 forestry jobs, and a total loss of 132 primary employment positions in the Nadina Forest District.

Table 29. Scenario 3.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	5.4	5.4	-0.1	-1.1
Forestry	508.8	488.9	-19.9	-3.9
Services	13.4	13.1	-0.3	-2.0
Public	61.4	61.0	-0.4	-0.7
Visitor	133.9	133.5	-0.4	-0.3
ROE	346.2	339.7	-6.5	-1.9
Total	1 069.3	1 041.6	-27.6	-2.6
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1.5	1.5	0.0	-1.5
Forestry	240.0	225.8	-14.2	-5.9
Services	9.6	9.4	-0.2	-2.2
Public	36.6	36.3	-0.3	-0.7
Visitor	34.0	33.9	-0.1	-0.3
ROE	81.8	80.3	-1.6	-1.9
Total	403.6	387.3	-16.4	-4.1
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.6	0.6	0.0	-1.5
Forestry	88.3	83.1	-5.2	-5.9
Services	1.7	1.7	0.0	-2.2
Public	6.9	6.9	-0.1	-0.7
Visitor	2.8	2.8	0.0	-0.3
ROE	5.1	5.0	-0.1	-1.9
Total	105.5	100.1	-5.4	-5.1
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.7	0.7	0.0	-1.5
Forestry	113.5	106.8	-6.7	-5.9
Services	7.6	7.4	-0.2	-2.2
Public	24.2	24.0	-0.2	-0.7
Visitor	25.0	25.0	-0.1	-0.3
ROE	60.8	59.6	-1.2	-1.9
Total	231.7	223.4	-8.3	-3.6
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	100	98	-2	-1.5
Forestry	1 310	1 233	-77	-5.9
Services	429	419	-10	-2.2
Public	454	451	-3	-0.7
Visitor	1 188	1 184	-4	-0.3
ROE	1 864	1 828	-36	-1.9
Total	5 345	5 213	-132	-2.5

Scenario 4

Scenario 4 simulates a 10.6% decrease in the Lakes TSA AAC in combination with an 8% increase in visitor activity in the Nadina Forest District. Increased tourism may be one way to offset negative impacts of a reduction in forestry activity. The visitor sector links most strongly with the domestic services sector and the rest of the economy (primarily retail). The visitor sector has a weak positive relationship with forestry, agriculture, and the public sector.

Increased visitor activity in the overall region partially offset the negative monetary impact of the reduction in forestry, and can completely offset the employment impact in terms of the aggregate number of jobs in the regions. However, there are gains and losses from each individual sector (Table 30).

Total regional revenue decreases by $10.1 million, with a loss of $18.0 million from the forestry sector and a gain of $9.4 million in the visitor sector. NRP directly from the visitor sector increases by $2.5 million, but this is overwhelmed by a $12.8-million loss of NRP from the forestry sector, equalling a net loss of $10.7-million total NRP. There is a minimal $4.5 million decrease in indirect taxes. The visitor sector gains $1.8 million in labour income, but this is overwhelmed by a loss of $6.0 million of labour income in the forest sector, contributing to a $4.5-million net loss in labour income. Eighty-eight visitor sector jobs are generated, but 70 jobs in forestry sector and an additional 10 jobs in other sectors disappear, contributing to a net increase of eight employment positions in the region.

Table 30. Scenario 4.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	5.4	5.4	0.0	-0.4
Forestry	508.8	490.9	-18.0	-3.5
Services	13.4	13.4	0.0	-0.3
Public	61.4	61.4	0.0	0.0
Visitor	133.9	143.3	9.4	7.0
ROE	346.2	344.8	-1.4	-0.4
Total	1 069.3	1 059.2	-10.1	-0.9
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1.5	1.5	0.0	-0.6
Forestry	240.0	227.2	-12.8	-5.3
Services	9.6	9.6	0.0	-0.3
Public	36.6	36.6	0.0	-0.1
Visitor	34.0	36.5	2.5	7.4
ROE	81.8	81.5	-0.3	-0.4
Total	403.6	393.0	-10.7	-2.6
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.6	0.6	0.0	-0.6
Forestry	88.3	83.6	-4.7	-5.3
Services	1.7	1.7	0.0	-0.3
Public	6.9	6.9	0.0	-0.1
Visitor	2.8	3.0	0.2	7.4
ROE	5.1	5.1	0.0	-0.4
Total	105.5	101.0	-4.5	-4.3
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.7	0.7	0.0	-0.6
Forestry	113.5	107.5	-6.0	-5.3
Services	7.6	7.5	0.0	-0.3
Public	24.2	24.1	0.0	-0.1
Visitor	25.0	26.9	1.8	7.4
ROE	60.8	60.5	-0.3	-0.4
Total	231.7	227.3	-4.5	-1.9
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	100	99	-1	-0.6
Forestry	1 310	1 240	-70	-5.3
Services	429	428	-1	-0.3
Public	454	454	0	-0.1
Visitor	1 188	1 276	88	7.4
ROE	1 864	1 856	-8	-0.4
Total	5 345	5 353	8	0.2

Scenario 5

Scenario 5 simulates a 10.6% reduction of the AAC in the Lakes TSA in combination with a 134.0% increase in agricultural exports from the region. Similar to Scenario 4, this considers potential mitigation of a reduction in AAC through increased agricultural activity. Visitor sector activity is held constant at the baseline level. The strongest links of the agricultural sector are with the rest of the economy (primarily retail) and, to a limited extent, forestry. The agriculture sector has a weak positive relationship with forestry, agriculture, and the public sector. However, agricultural links are weak overall.

Similar to Scenario 4, this combined scenario yields a simulated $17.9 million decrease in the overall economy-wide revenue (Table 31). This is primarily the result of an $18.3-million decrease in forestry and

a $3.8-million increase in the agriculture sector. The results also indicate a $13.0-million decrease in NRP derived from forestry and a $1.5-million increase in the NRP derived from agriculture, for a net NRP decrease of $12.4 million. Similar results are seen for royalties and indirect taxes and for labour income. Overall, royalties and indirect taxes are reduced by $4.3 million and labour income is reduced by $6.2 million. The increase in agricultural exports leads to an increase of 95 jobs in agriculture and a net total of 3 new positions in the forest district. Similar to the Scenario 4, the mitigation strategy offsets the overall employment impact, but does not offset the negative net impact on monetary indicators, highlighting the relatively high monetary wealth derived from the forest sector compared to that from other sectors.

Table 31. Scenario 5.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	5.4	9.2	3.8	69.5
Forestry	508.8	490.6	-18.3	-3.6
Services	13.4	13.3	-0.1	-0.7
Public	61.4	61.3	-0.1	-0.1
Visitor	133.9	133.8	-0.1	-0.1
ROE	346.2	343.2	-3.1	-0.9
Total	1 069.3	1 051.4	-17.9	-1.7
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1.5	3.0	1.5	95.5
Forestry	240.0	227.0	-13.0	-5.4
Services	9.6	9.6	-0.1	-0.8
Public	36.6	36.5	0.0	-0.1
Visitor	34.0	34.0	0.0	-0.1
ROE	81.8	81.1	-0.7	-0.9
Total	403.6	391.2	-12.4	-3.1
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.6	1.1	0.6	95.5
Forestry	88.3	83.5	-4.8	-5.4
Services	1.7	1.7	0.0	-0.8
Public	6.9	6.9	0.0	-0.1
Visitor	2.8	2.8	0.0	-0.1
ROE	5.1	5.1	0.0	-0.9
Total	105.5	101.2	-4.3	-4.1
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	0.7	1.4	0.7	95.5
Forestry	113.5	107.4	-6.2	-5.4
Services	7.6	7.5	-0.1	-0.8
Public	24.2	24.1	0.0	-0.1
Visitor	25.0	25.0	0.0	-0.1
ROE	60.8	60.2	-0.6	-0.9
Total	231.7	225.6	-6.2	-2.7
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	100	195	95	95.5
Forestry	1 310	1 239	-71	-5.4
Services	429	426	-3	-0.8
Public	454	453	-1	-0.1
Visitor	1 188	1 187	-1	-0.1
ROE	1 864	1 847	-17	-0.9
Total	5 345	5 348	3	0.0

Key Scenario Messages

- The forestry sector is closely linked to the domestic services and the rest of the economy (primarily retail) sectors. Any changes in the forestry sector will have the greatest indirect impact on services and retail.
- The forestry sector has weak positive relationships with the agriculture sector and the visitor sector. Positive (negative) impacts in forestry result in positive (negative) indirect impacts in agriculture and visitor activity, but the effects are minimal.
- A 97.5% increase in the AAC of the Lakes TSA results in increased economic activity across all sectors of the economy. Similarly, a 10.6% reduction of the AAC in the Lakes TSA leads to decreased economic activity across all sectors of the economy.
- Regional economic activity will increase in the Nadina Forest District over the next 10 to 15 years resulting from increases in AAC to address the current mountain pine beetle infestation. This relative boom may be short-lived as the AAC increases are intended to capture the value of the dead standing timber on the landscape.
- After 10 to 15 years, it is anticipated that the district will experience a reduction of 4.6% in the AAC from the baseline, which will result, on average and without mitigation, in a regional, per annum:
    - Revenue drop of $27.6 million (2.6%).
    - Net regional product reduction of $16.4 million (4.1%).
    - Reduction of royalties and indirect taxes by $5.4 million (5.1%).
    - Decrease of $8.3 million (3.6%) of total labour income.
    - Loss of 132 (2.5%) employment positions.
- An 8.0% increase in aggregate visitor activity will partially offset the negative monetary impacts of a 4.6% decrease in the AAC in the Nadina Forest District (10.6% in the Lakes TSA), and can completely offset the impact in terms of employment numbers, although the nature of employment may differ.
- Increasing agricultural exports by 134.0% will benefit the economy, but will only partially offset the negative monetary impacts associated with a 4.6% reduction in AAC in the district (10.6% in the Lakes TSA).
- An 8.0% increase in visitor activity or a 134.0% increase in agricultural exports can offset the number of jobs lost due to an anticipated 4.6% decrease in district AAC, but neither scenario can offset the negative net impact on monetary indicators.

Prince George Timber Supply Area

Scenario Descriptions

Four scenarios examined effects of increases in AAC resulting from mountain pine beetle damage, negative impacts on AAC from reductions in AAC resulting from the current mountain pine beetle damage, and an increase in visitor activity on the Prince George TSA economy (Table 32).

The baseline AAC level in the TSA used for this analysis is 9,360,000 m^3 (BCMoF 2004d). This level was set in 1996, and was maintained until 2002. In response to the mountain pine beetle infestation the AAC was raised to 12,244,000 m^3 in June, 2002, and was further increased to 14,944,000 in October, 2004 (BCMoF 2004d). A recent B.C. Ministry of Forests timber supply review included a longer-term assessment of the future AAC level in light of the mountain pine beetle impact on the forest. The current projection of the sustainable AAC level in the TSA is anticipated to be 7,880,000 m^3 (BCMoF 2004d). The reduction in the level of AAC is expected in approximately 15 years.

Table 32. Description of Prince George TSA scenarios.

Scenario	Description
1	30.8% increase in the AAC of the Prince George TSA
2	59.7 increase in the AAC of the Prince George TSA
3	-15.8% reduction in the AAC of the Prince George TSA
4	Scenario 3 combined with a 21.0% increase in visitor activity

Scenario Results

Table 33 summarizes simulated changes in the economic indicators for the respective scenarios. The scenario results are expressed in terms of the average annual indicator level after the shock and percent change from the baseline indicator level.

Table 33. Prince George TSA scenario results comparison chart.

	Baseline	**Scenario 1**		**Scenario 2**		**Scenario 3**		**Scenario 4**	
			%		%		%		%
Total revenue ($M)	10 651.9	11 796.1	10.7	12 867.3	20.8	10 064.8	-5.5	10 577.4	-0.7
Total net regional product ($M)	3 160.8	3 690.3	16.8	4 186.0	32.4	2 889.1	-8.6	3 016.4	-4.6
Total royalties and indirect taxes ($M)	733.8	898.9	22.5	1 053.4	43.5	733.8	-11.5	678.8	-7.5
Total labour income ($M)	1 605.3	1 797.7	12.0	1 977.9	23.2	1 506.5	-6.2	1 574.2	-1.9
Total employment (#)	55 740	60 923	9.3	65 774	18.0	53 080	-4.8	55 816	0.1

Scenario 1

Scenario 1 is a simulation of the impact on the economy of the Prince George TSA with a 30.8% increase in the AAC from the baseline[*]. The simulated shock would result in a new AAC level of 12,244,000 m^3.

The results indicate an economy-wide increase across all sectors in revenue, NRP, royalties and indirect taxes, labour income, and employment (Table 34). This means that as the AAC of the region increases, the positive impact ripples through the other sectors. Domestic services and the rest of the economy (primarily retail) are the sectors with the greatest linkages to forestry and, therefore, benefit the most from an increase in the available timber supply. Impacts on forestry appear to have a very minimal effect on the agriculture and visitor sectors.

A 30.8% increase of the AAC in the Prince George TSA yields a simulated $573.4 million increase in forestry sector revenue and an increase in the overall economy-wide revenue of $1,144.2 million. The increase in forestry activity also results in an increase of $406.9 million in NRP from the forestry sector and an overall increase of $529.5 million of NRP in the regional economy. Forestry accounts for $139.7 million of the $165.0 million change in overall royalties and indirect taxes. Forestry also accounts for $122.5 million of the overall $192.4 million change in total labour income and 2,362 of the 5,183 total employment positions gained from the increase in AAC.

[*] It is assumed that, on average, the annual allowable cut is equal to the amount of timber harvested.

Table 34. Scenario 1

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	49.4	50.0	0.7	1.3
Forestry	2 359.1	2 932.4	573.4	24.3
Services	3 327.6	3 638.4	310.8	9.3
Public	672.1	692.3	20.2	3.0
Visitor	805.8	826.0	20.3	2.5
ROE	3 437.9	3 656.8	218.9	6.4
Total	10 651.9	11 796.1	1 144.2	10.7
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	30.2	30.6	0.5	1.5
Forestry	1 149.9	1 556.8	406.9	35.4
Services	597.6	653.4	55.9	9.3
Public	506.3	521.8	15.5	3.1
Visitor	178.1	182.9	4.8	2.7
ROE	698.8	744.7	45.9	6.6
Total	3 160.8	3 690.3	529.5	16.8
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	5.3	5.4	0.1	1.5
Forestry	394.9	534.6	139.7	35.4
Services	206.1	225.4	19.3	9.3
Public	22.8	23.5	0.7	3.1
Visitor	41.7	42.9	1.1	2.7
ROE	62.9	67.0	4.1	6.6
Total	733.8	898.9	165.0	22.5
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	19.5	19.8	0.3	1.5
Forestry	346.2	468.7	122.5	35.4
Services	294.5	322.1	27.5	9.3
Public	450.7	464.5	13.8	3.1
Visitor	108.6	111.5	2.9	2.7
ROE	385.8	411.2	25.4	6.6
Total	1 605.3	1 797.7	192.4	12.0
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1 435	1 457	22	1.5
Forestry	6 675	9 037	2 362	35.4
Services	11 145	12 187	1 042	9.3
Public	12 845	13 239	394	3.1
Visitor	4 925	5 057	132	2.7
ROE	18 715	19 945	1 230	6.6
Total	55 740	60 923	5 183	9.3

Scenario 2

Scenario 2 represents a 59.7% increase in the AAC in the Prince George TSA from the baseline 9,360,000 m^3 to a new level of 14,944,000 m^3. Similar to Scenario 1, the results indicate an increase in the level of each indicator across all sectors (Table 35). Total regional revenue increases by $2,215.4 million with approximately half of that—($1,110.2 million—coming directly from the forestry sector. The NRP derive from the forestry sector increases by $787.9 million contributing to the overall $1,025.2 million increase in the total NRP for the TSA.

Under this scenario, royalties and indirect taxes paid by the forestry sector increase by $270.6 million of the overall total increase of $319.6 million. Overall labour income is augmented by $372.6 million with an impact on forestry labour income of $237.2 million. A simulated 10,034 direct and indirect employment positions are gained, including 4,574 jobs in the forestry sector.

Table 35. Scenario 2.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	49.4	50.7	1.3	2.6
Forestry	2 359.1	3 469.2	1 110.2	47.1
Services	3 327.6	3 929.4	601.8	18.1
Public	672.1	711.2	39.0	5.8
Visitor	805.8	845.0	39.2	4.9
ROE	3 437.9	3 861.8	423.9	12.3
Total	10 651.9	12 867.3	2 215.4	20.8
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	30.2	31.1	0.9	2.9
Forestry	1 149.9	1 937.7	787.9	68.5
Services	597.6	705.7	108.2	18.1
Public	506.3	536.4	30.1	5.9
Visitor	178.1	187.4	9.3	5.2
ROE	698.8	787.7	88.9	12.7
Total	3 160.8	4 186.0	1 025.2	32.4
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	5.3	5.5	0.2	2.9
Forestry	394.9	665.4	270.6	68.5
Services	206.1	243.4	37.3	18.1
Public	22.8	24.2	1.4	5.9
Visitor	41.7	43.9	2.2	5.2
ROE	62.9	70.9	8.0	12.7
Total	733.8	1 053.4	319.6	43.5
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	19.5	20.1	0.6	2.9
Forestry	346.2	583.4	237.2	68.5
Services	294.5	347.8	53.3	18.1
Public	450.7	477.4	26.8	5.9
Visitor	108.6	114.2	5.6	5.2
ROE	385.8	434.9	49.1	12.7
Total	1 605.3	1 977.9	372.6	23.2
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1 435	1477	42	2.9
Forestry	6 675	11 249	4 574	68.5
Services	11 145	13 162	2 017	18.1
Public	12 845	13 609	764	5.9
Visitor	4 925	5 181	256	5.2
ROE	18 715	21 097	2 382	12.7
Total	55 740	65 774	10 034	18.0

Scenario 3

Scenario 3 examines the negative consequences of an anticipated 15.8 % reduction in the available timber supply in the TSA due to mountain pine beetle damage. The simulated shock would result in a new AAC level of 7,880,000 m^3.

Scenario 3 results in simulated negative impacts across all sectors of the regional economy (Table 36). In total, $587.2 million is lost in gross revenue with $294.2 million lost directly from the forestry sector. NRP declines by $208.8 million in the forestry sector and $271.7 million in total. The reduced timber supply also yields a simulated $71.7 million loss of royalties and indirect taxes paid by the forestry sector and an economy-wide reduction of $84.7 million from the region. Similarly, labour income in the forestry sector decreases by $62.9 million and is reduced by a total of $98.8 million across all the sectors. A 15.8% reduction in the AAC of the Prince George TSA also yields a simulated decline of 1,212 jobs in the forestry sector and an overall decrease of 2,660 employment positions in the region.

Table 36. Scenario 3.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	49.4	49.1	-0.3	-0.7
Forestry	2 359.1	2 064.8	-294.2	-12.5
Services	3 327.6	3 168.1	-159.5	-4.8
Public	672.1	661.8	-10.3	-1.5
Visitor	805.8	795.4	-10.4	-1.3
ROE	3 437.9	3 325.6	-112.3	-3.3
Total	10 651.9	10 064.8	-587.2	-5.5
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	30.2	29.9	-0.2	-0.8
Forestry	1 149.9	941.0	-208.8	-18.2
Services	597.6	568.9	-28.7	-4.8
Public	506.3	498.3	-8.0	-1.6
Visitor	178.1	175.7	-2.5	-1.4
ROE	698.8	675.2	-23.6	-3.4
Total	3 160.8	2 889.1	-271.7	-8.6
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	5.3	5.3	0.0	-0.8
Forestry	394.9	323.2	-71.7	-18.2
Services	206.1	196.2	-9.9	-4.8
Public	22.8	22.5	-0.4	-1.6
Visitor	41.7	41.2	-0.6	-1.4
ROE	62.9	60.8	-2.1	-3.4
Total	733.8	649.1	-84.7	-11.5
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	19.5	19.4	-0.2	-0.8
Forestry	346.2	283.3	-62.9	-18.2
Services	294.5	280.4	-14.1	-4.8
Public	450.7	443.6	-7.1	-1.6
Visitor	108.6	107.1	-1.5	-1.4
ROE	385.8	372.8	-13.0	-3.4
Total	1 605.3	1 506.5	-98.8	-6.2
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1 435	1 424	-11	-0.8
Forestry	6 675	5 463	-1 212	-18.2
Services	11 145	10 610	-535	-4.8
Public	12 845	12 643	-202	-1.6
Visitor	4 925	4 857	-68	-1.4
ROE	18 715	18 084	-631	-3.4
Total	55 740	53 080	-2 660	-4.8

Scenario 4

Scenario 4 simulates a 15.8% reduction in the AAC of the Prince George TSA in combination with a hypothetical mitigation strategy that would increase visitor activity by 21.0%. The change in the AAC under this scenario is identical to Scenario 3 with a reduction from the baseline level of 9,360,000 m^3 to a new (post-beetle) level of 7,880,000 m^3. It is assumed that a strategy to increase tourism may be one way to offset some of the negative impacts of a reduction in forestry activity. Although limited in scope, this scenario highlights the offsetting impacts that mitigation strategies may have and the benefit of examining the development of other sectors of the economy in an economy-wide framework.

The results of scenario 4 yield a negative impact in the level of each indicator for agriculture, forestry and the public sector; conversely, a positive impact is achieved for each indicator across the service sector, the visitor sector and the rest of the economy (Table 37). This scenario was designed to show that, in aggregate, a 21.0% increase in visitor activity can offset the negative employment impacts of a 15.8% decrease in forestry activity, but can only partially offset the negative impact on the monetary indicators like revenue, NRP, royalties and indirect taxes, and labour income. The net impact on the monetary indicators from this combination scenario is negative.

Total regional revenue decreases by $74.5 million despite a $147.1 million increase in visitor sector revenue. The benefits gained in the visitor sector are overwhelmed by the reduction in forestry revenue of $263.8 million. This scenario also results in a loss of $144.4 million of total NRP (compared to $271.7 million under Scenario 3), $55.0 million of royalties and indirect taxes (compared to $84.7 million under Scenario 3), $31.0 million of labour income (compared to $98.8 million under Scenario 3), and 76 jobs gained (compared to 2,660 jobs lost under Scenario 3).

Although a hypothetical 21.0% increase in visitor activity may be able to offset the negative employment impact of the forestry reduction in terms of employment numbers, it is important to consider that the nature of visitor sector employment is different from employment in the forestry sector.

Table 37. Scenario 4.

Revenue ($M)	Baseline	Simulated indicator level	Level change	% change
Agriculture	49.4	49.2	-0.2	-0.4
Forestry	2 359.1	2 095.3	-263.8	-11.2
Services	3 327.6	3 335.9	8.3	0.2
Public	672.1	671.4	-0.8	-0.1
Visitor	805.8	952.9	147.1	18.3
ROE	3 437.9	3 472.8	34.9	1.0
Total	10 651.9	10 577.4	-74.5	-0.7
NRP ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	30.2	30.0	-0.2	-0.5
Forestry	1 149.9	962.7	-187.2	-16.3
Services	597.6	599.0	1.5	0.2
Public	506.3	505.7	-0.6	-0.1
Visitor	178.1	212.9	34.8	19.5
ROE	698.8	706.1	7.3	1.0
Total	3 160.8	3 016.4	-144.4	-4.6
Royalties ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	5.3	5.3	0.0	-0.5
Forestry	394.9	330.6	-64.3	-16.3
Services	206.1	206.7	0.5	0.2
Public	22.8	22.8	0.0	-0.1
Visitor	41.7	49.9	8.1	19.5
ROE	62.9	63.5	0.7	1.0
Total	733.8	678.8	-55.0	-7.5
Labour income ($M)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	19.5	19.4	-0.1	-0.5
Forestry	346.2	289.8	-56.4	-16.3
Services	294.5	295.3	0.7	0.2
Public	450.7	450.1	-0.5	-0.1
Visitor	108.6	129.7	21.2	19.5
ROE	385.8	389.8	4.0	1.0
Total	1 605.3	1 574.2	-31.0	-1.9
Employment (#)	**Baseline**	**Simulated indicator level**	**Level change**	**% change**
Agriculture	1 435	1 428	-7	-0.5
Forestry	6 675	5 588	-1 087	-16.3
Services	11 145	11 173	28	0.2
Public	12 845	12 830	-15	-0.1
Visitor	4 925	5 886	961	19.5
ROE	18 715	18 911	196	1.0
Total	55 740	55 816	76	0.1

Key Scenario Messages

- The forestry sector is most closely linked to the services sector and the rest of the economy (primarily retail) sector. Any changes in the forestry sector will have the greatest indirect impact on services and retail.
- Regional economic activity will increase in the Prince George TSA over the next 10 to 15 years resulting from increases in the AAC to address the current mountain pine beetle infestation. This relative boom may be short-lived as the increases in AAC are intended to capture the value of the dead standing timber on the landscape.
- After 10 to 15 years it is anticipated that the TSA will experience a reduction of 15.8% in the AAC from the baseline and will result, on average and without mitigation, in a regional, pre annum:
    - Revenue drop of $587.2 million (5.5%).
    - Net regional product reduction in $271.7 million (8.6%).
    - Reduction of royalties and indirect taxes paid by $84.7 million (11.5%).
    - Decrease of $98.8 million of total labour income (6.2%).
    - Loss of 2,660 employment positions (4.8%).
- It is possible to fully mitigate the employment impacts, in terms of the number of jobs, of a 15.8% reduction of timber supply through a 21.0% increase in visitor activity.
- Although a strategy to increase visitor activity will mitigate some or all of the negative forestry impacts in terms of job numbers, visitor sector employment is characterized by relatively lower wages and an increase of part time and seasonal work.
- It may be possible to further mitigate negative impacts in the forestry sector by strategies to increase other existing sectors, such as mining, and through structural adjustments and the development of new products and sectors.

Conclusion

The forest-dependent communities of the Northern Interior Forest Region of British Columbia are facing a period of transition resulting from the magnitude of the current mountain pine beetle infestation. Detailed baseline economic databases were constructed for two study regions located in the Northern Interior Forest Region: the Nadina Forest District and the Prince George Timber Supply Area. The databases provide: a snapshot of the state of the regional economies prior to the realization of mountain pine beetle impacts on annual allowable cut, and the information necessary to construct region-specific general equilibrium models.

A computable general equilibrium framework was employed for the purpose of simulating future economic indicator levels for the two regions that are experiencing mountain pine beetle pressure. For each region a set of scenarios reflecting the impacts of recent increases in the annual allowable cut, the expected future reduction in the annual allowable cut, and hypothetical mitigation strategies involving visitor sector activity and increased agricultural exports were analyzed.

In the shorter-term (15 years or less), the available timber supply will be characterized by increases from the baseline annual allowable cut in order to capture the value of the standing dead timber. In the longer-term (greater than 15 years), reductions in the annual allowable cut are expected resulting from the mountain pine beetle mortality and the lag time needed to regenerate the forest. In the longer-term, mitigation strategies will be required to offset any negative consequences associated with reductions in the available timber supply.

The shorter-term impacts will reflect a relative boom to the regional economies as forest sector activity increases to handle the volume of available timber resulting from mountain pine beetle damage. This increased activity will cycle throughout the economy providing spin-off benefits to other sectors such as the service sector and retail trade. However, these spin-off impacts may be somewhat muted as individuals and industries brace for the expected future reduction in the timber supply or re-invest capital in order to transition to new forms of industry and employment.

The longer-term economic implications of the mountain pine beetle infestation are negative as the available timber supply is expected to fall below the baseline level. In other words, the economies will not return to a business-as-usual state once the beetle-kill timber runs out or no longer contains marketable value. At this turning point, the regional economies will be forced to transition or the level of gross economic activity will shrink, if all else is held constant. For example, increased visitor sector activity (tourism) is used as a hypothetical mitigation strategy to demonstrate how the negative economic implications associated with reduced forestry activity can potentially be partially or completely offset through transition.

Finally, the economic impact models used in this study are not without their flaws and as a consequence, the results should be interpreted with caution. The simulation results demonstrate a snapshot of the new state of the economy after a shock—all else held constant—based on an initial snapshot of the baseline industrial structure and are not forecasts.

Acknowledgments

This project was funded by the Government of Canada through the Mountain Pine Beetle Initiative, a six-year, $40-million program administered by Natural Resources Canada, Canadian Forest Service, in partnership with the Morice and Lakes Innovative Forest Practices Agreement, and the McGregor Model Forest Association. The authors wish to thank Christina Okinczyc for her technical assistance with the preparation of this report.

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Appendix A

The generalized equations that form the theoretical structure of the regional CGE models.

1. $L_j = X_j - (W - (\alpha_w W + \alpha_{kj} R_j^K + \alpha_{Dj} R_j^D))$	j = 1,2,...,6
2. $ELF = \sum_{j=1}^{n} \beta_j L_j$	j = 1,2,...,6
3. $K_j = X_j - (R_j^K - (\alpha_w W + \alpha_{kj} R_j^K + \alpha_{Dj} R_j^D))$	j = 1,2,...,6
4. $D_j = X_j - (R_j^D - (\alpha_w W + \alpha_{kj} R_j^K + \alpha_{Dj} R_j^D))$	j = 1,2,...,6
5. $X_{ij} = X_j$	i,j = 1,2,...,6
6. $X_{jc} = Y - P_j$	j = 1,2,...,6
7. $X_i = \sum_{j=1}^{n} \varphi_{ij} X_{ij} + \eta_i X_{ic} + \theta_i E_i + \eta_g G_i$	i = 1,2,...,5 j = 1,2,...,6
8. $E_i = -\phi(P_i - Wp_i + er)$	i = 1,2,...,5
9. $P_j = \sum_{n=1}^{n} \delta_{nj} P_n + (\delta W_j + \delta_{kj} R_j^K + \delta_{Dj} R_j^D + \delta_m PM_j + \delta_t GT_j)$	j = 1,2,...,6
10. $Y = \alpha_i ELF_i + \alpha_i W + \zeta_i K_i + \zeta_i R_i^K + \lambda_j D_j + \lambda_j R_i^D + \lambda_g G$	i,j = 1,2,...,6

The endogenous variables contained within the regional CGE models. Note that depending on the scenario in question, various endogenous variables can be switched with exogenous variables. This allows for a greater degree of flexibility in the range of scenarios and solution techniques possible.

L_i i=1,...,6	Labour employed in sector i
X_i i=1,...,6	Output of sector i
R_i^K i=1,...,6	Rental rate of capital in sector i
R_i^D i=1,...,6	Rental rate of land in sector i
D_i i=1,...,6	Land employed in sector i
X_{ic} i=1,...,6	Final demand for output from sector i
Y	Household income
P_i i=1,...,6	Domestic price of output from sector i
E_i i=1,...,5	Exports from sector i
ELF*	Employed Labour Force
W*	Wage rate

* If W is endogenous ELF is exogenous and vice versa

The exogenous variables contained within the regional CGE models. Again, depending on the scenario in question various variables can be switched between endogenous and exogenous.

K_i i=1,...,6	Capital employed in sector i
D_i i=1,...,6	Land employed in sector i
X_{ic} i=1,...,6	Final demand for output from sector i
WP_i i=1,...,6	World price of output from sector i
Er	Foreign exchange rate
G_i i=1,...,6	Government expenditure in sector i
PM, i=1,...,6	Price of imports in sector i
GTi i=1,...,6	Indirect taxes in sector i
WLE	World labour export
GTF	Government transfers to households

This publication is funded by the Government of Canada through the Mountain Pine Beetle Initiative, a program administered by Natural Resources Canada, Canadian Forest Service (web site: mpb.cfs.nrcan.gc.ca).

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